A FUNCTIONAL COURSE OF STUDY IN BUSINESS ARITHMETIC BASED ON THE ACTUAL NEEDS OF THREE BUSINESS ARITHMETIC CLASSES IN THE BUSINESS COURSE AT THE CLASSICAL AND HIGH SCHOOL, SALEM, MASSACHUSETTS

Mizzi, D A functional course of study in business
1947 Arithmetic. . .

BOSTON UNIVERSITY
SCHOOL OF EDUCATION
Ed.
LIBRARY

Thesis
Mizzi, D.
1947

The Gift of Domenico Mizzi

Ed
Thesis
Mizzi,D
1947
Stored

BOSTON UNIVERSITY

SCHOOL OF EDUCATION

THESIS

A FUNCTIONAL COURSE OF STUDY IN BUSINESS ARITHMETIC BASED ON THE ACTUAL NEEDS OF THREE BUSINESS ARITHMETIC CLASSES IN THE BUSINESS COURSE AT THE CLASSICAL AND HIGH SCHOOL, SALEM, MASSACHUSETTS

Submitted by

Domenico Mizzi

(B.S. in Ed., Salem Teachers College)

In partial fulfillment of requirements for
the degree of Master of Education

1947

First Reader: Dr. John L. Rowe, Associate Professor of Business Ed.

Second Reader: Mr. William H. Cartwright, Assistant Prof. of Education

Third Reader: Mr. Vaden W. Miles, Assistant Prof. of Teaching of Science

Boston University
School of Education
Library

School of education
Gift of D. Mizzi
December 27, 1946
27614

TABLE OF CONTENTS

CHAPTER	TITLE	PAGE
I	BUSINESS ARITHMETIC: A CONTROVERSIAL ISSUE	1
II	REVIEW OF RELATED LITERATURE	11
III	PROCEDURES IN GATHERING DATA	27
IV	ANALYSIS AND INTERPRETATION OF DATA	35
V	FINDINGS AND RECOMMENDATIONS	49
	THE FUNCTIONAL COURSE OF STUDY	58
VI	A SUMMARY OF THE STUDY	96
	BIBLIOGRAPHY	103
	APPENDIX	108

LIST OF TABLES

TABLE NUMBER		PAGE NUMBER
I	Scores of the Metropolitan Advanced Arithmetic Test administered to 20 ninth-grade pupils in a business arithmetic class at the Classical and High School in Salem, Massachusetts.	35
II	Scores of the Metropolitan Advanced Arithmetic Test administered to 21 ninth-grade pupils in a business arithmetic class at the Classical and High School in Salem, Massachusetts.	37
III	Scores of the Metropolitan Advanced Arithmetic Test administered to 31 ninth-grade pupils in a business arithmetic class at the Classical and High School in Salem, Massachusetts.	38
IV	Combined scores of the Metropolitan Advanced Arithmetic Test administered to 72 ninth-grade pupils in three business arithmetic classes at the Classical and High School in Salem, Massachusetts.	39
V	Scores of the Metropolitan Advanced Arithmetic Test administered to 15 twelfth-grade pupils in a bookkeeping class at the Classical and High School in Salem, Massachusetts.	42
VI	Comparative scores of the Metropolitan Advanced Arithmetic Test administered to 25 pupils in the eighth-grade and administered four months later to the same pupils in the ninth-grade while members in a business arithmetic class at the Classical and High School in Salem, Massachusetts.	44
VII	A tabulation of problems in the Metropolitan Advanced Arithmetic Test showing the number of problems solved correctly, the number of problems computed incorrectly and the number of problems omitted by 72 ninth-grade pupils of three business arithmetic classes at the Classical and High School in Salem, Massachusetts.	45

CHAPTER I

BUSINESS ARITHMETIC: A CONTROVERSIAL ISSUE

A study of publications and articles on the subject of business arithmetic reveals a great many controversial opinions as to the value of teaching the subject, the grade in which it should be taught, and the possibility of the effectiveness of teaching the subject in conjunction with other business courses such as bookkeeping and junior business training. Even the term business mathematics is gradually displacing the term commercial arithmetic which is the title of an arithmetic course commonly offered in the ninth year of school as a basic and preliminary study for pupils who select the business course in high schools.

The close relationship of the subject business arithmetic, formerly known as commercial arithmetic, to the business course can be traced as far back as the early part of the eighteenth century when records show that the subject was taught in conjunction with bookkeeping at the Classical and High School of Salem, Massachusetts in 1836. The growth in the teaching of business arithmetic paralleled the phenomenal growth of high schools and business courses during 1920 to 1930 when high schools offering business courses increased from 3,742 to 15,000 and pupils taking the business courses increased from 208,605 to 1,700,000 in 1935.

Business arithmetic taught in the early stages consisted of the emphasis on the fundamentals of arithmetic and its use in general clerical positions. Because of the economic development in this country in the past few decades the subject now is not only important for its use in business activities but also becomes increasingly important as a personal factor in the understanding and ability of a person to compute and solve problems in banking, buying, travel and transportation, insurance, use of public utilities, and tax transactions.

A course of study in business arithmetic consists of essential material and information based on arithmetical fundamentals presented as they are used in business activities so that when studied and mastered by pupils, the learning can be applied successfully either in their personal or vocational relationships with business to understand and solve arithmetical problems arising out of business activities.

A business or commercial course of study is made up of a group of business subjects together with required English and social subjects. In the ninth year the business course offers business arithmetic and junior business training. In the tenth year pupils select their specialization which may be in accounting, stenography, clerical, or retailing fields. Courses in the above mentioned fields are offered in the tenth, eleventh, and twelfth grades to pupils taking the business course. The aim of the business course of study is to prepare the students for a vocation in business.

Junior Business Training is the title of a course that consists of information and materials based upon business activities presented for their exploratory and personal value to the pupils interested in selecting business as a vocation for future life. Such a course enables a pupil to acquire an understanding of fundamental business practice, an understanding of the relationship between business and society, a knowledge of aptitudes, abilities, skills, and interests necessary for success in the field of business, and provides a basic background for the further study of business. This course is also known as General Business, Business Training, and Elementary Business Training.

The Classical and High School of Salem, Massachusetts is one of the oldest and best high schools in the Commonwealth of Massachusetts. It has an enrollment at the present time of approximately 1400 pupils. The principal courses offered are the Classical, Scientific, Commercial, and General. The business course offers five specializations for its pupils, namely: Accounting, Stenographic, General Clerical, Office Practice, and Retailing. About one-third of the school population follows the business course and approximately one-fifth of the faculty of 60 are business teacher specialists.

Bookkeeping is the title of a course of study based upon actual problems in maintaining financial records for a business. Materials and information are provided that will enable a pupil, upon mastery of the subject, to efficiently keep a

set of books and prepare financial statements for a small business. The average business course in a high school offers two to three years of upgraded study in bookkeeping to pupils who select that specialization.

The educators who believe that business arithmetic should not be taught contend that pupils have had arithmetic for seven or eight years during their primary and elementary grades and that they should have a satisfactory skill and background in the subject which should avoid the necessity of repeating the work they already have had. Moreover, many studies have been made of the arithmetical needs of the vast majority of people who do not use mathematics in a technical manner and therefore the fundamental needs are very few. Some authorities even go so far as stating that business arithmetic should be entirely abolished. Others bring up the question of what is arithmetic for business and how does it differ from other arithmetic. Another point of view is that the subject, if taught at all, should be taught by the mathematic department of the high school.

In contrast to the arguments against the teaching of business arithmetic there are many logical arguments for teaching the subject. If one agrees that the fundamental needs of arithmetical knowledges are few one must admit that in those few knowledges, a high proficiency of skill is desired. Surveys the country over show that employers are almost unanimous in favoring more rather than less business arithmetic teaching.

Moreover it is difficult to escape from the fact that a knowledge of arithmetic is essential to the mastery of bookkeeping and several other business subjects such as selling, retailing, business law, geography and economics. Business arithmetic is a combination of business and mathematical relationships and specific associations of numbers which can best be acquired by drill. Therefore business arithmetic should be developed as a separate course since it is primarily a skill and should be taught as such.

There are other business educators who believe that business arithmetic should be taught as part of a course in bookkeeping or junior business training. The present consensus of opinion seems to be definitely in favor of correlating arithmetic with junior business training and bookkeeping but whether this correlation can be effective enough to eliminate the need for a separate class is contentious. Since the abstract teachings do not stick, the claim is made that meaningful situations are developed in specific subjects such as bookkeeping and junior business training in which time should be taken for arithmetical and drill applications. Others claim that correlation requires expert supervision and superior teaching and it is doubtful if correlation will insure needed competency in the students.

A few authorities recommend the introduction of clinical or remedial arithmetic classes. It would be desirable to have a separate class based upon diagnosis and remedial teaching

where pupils would receive special attention until their particular difficulty is remedied. Another worthwhile suggestion is offered in holding a clinical arithmetic class in the last semester of high school. Naturally clinical teaching would be ideal since the pupils would receive individual attention but such a procedure would be very expensive and specialist teachers would have to be obtained.

Some of the findings on research in business arithmetic reveal that scores made by students in final tests show very little improvement over initial tests and that students are likely to spend a great deal of time studying procedures they know well from the start. Since the responsibility for the deficiency is placed on the teachers it is felt that the lack of training in psychology and methods of teaching arithmetic on the part of business teachers makes them ineffective. It is also felt that the responsibility for the development of arithmetical ability should be placed upon the mathematics teachers rather than upon the business teachers. Moreover, a procedure of determining the pupils' individual deficiencies and the provision of remedial instruction for those particular defects has indicated a successful approach to the solution of the problem.

Businessmen complain about the inability of students in making satisfactory calculations especially in speed and accuracy. Error studies are almost unanimous in pointing to weaknesses of fundamental operations, fractions, and decimals.

Investigations of the type of calculations found in business offices indicate that simple fundamentals, simple fractions, decimals and percentages predominate. It is apparent, therefore, that business arithmetic does not differ a great deal from any other kind of arithmetic.

Notwithstanding the reasonableness of the arguments and findings of the authorities in the matter of whether or not business arithmetic should be taught, whether the subject should be correlated with other business subjects, or whether the subject should be taught by the mathematics departments, the fact remains that surveys the country over show that employers are almost unanimous in favoring more rather than less business arithmetic teaching. Since the employers are the people who hire commercial students, on that basis alone it would seem justifiable to offer business arithmetic as a separate course.

Business arithmetic has been taught in business departments since their beginning and about one-fourth of the business pupils take a full year of the subject. Moreover, the subject is very popular in senior and four year high schools. In general, business arithmetic is not taught exclusively in any one year, but it is offered extensively in both the ninth and tenth years, and occasionally in the twelfth year. The advantage of teaching the subject in the twelfth year is that an intensive review course prepares the students to enter business with a refreshed knowledge of the subject and recent

practice in rapid calculation, arithmetical computations, and skill development. This feature helps overcome the chief criticism made by the employers.

It appears sound to offer business arithmetic in the junior high school or in the first year of a four year high school so that it may be used in the study of more advanced business subjects. A knowledge of arithmetic is essential to the mastery of bookkeeping. A course in retailing or selling includes the preparation of sales slips, orders, and reports that require the use of arithmetic. Even business law takes in the study of negotiable instruments which involve arithmetical calculations.

Some high schools offer courses in business arithmetic and junior business training and encourage business pupils to take those courses the same year. In a set up of that type excellent results can be obtained since the correlation of the material presented in both courses is naturally and closely related. When the courses are not offered concurrently, it would be better to offer the arithmetic course before the junior business training course since a knowledge of arithmetical fundamentals can be very useful in the study of junior business training or general business.

Another common practice in high schools is to offer a semester of business arithmetic in the ninth or tenth year that is required of all business students. Other high schools add to the semester offered in the first year another semester in

the twelfth year for bookkeeping, clerical, and salesmanship majors.

In summarizing the controversial arguments for the continuance or the discontinuance of the teaching of business arithmetic one comes to the conclusion that there is a need for a great deal of thought and experimentation through research in the field before a positive decision can be made. It appears that a great many of the critics lose sight of the fact that business arithmetic is fundamentally a vocational subject and is only offered to commercial students who plan in entering positions where the knowledge of arithmetic is essential. If studies reveal that a year or a semester of business arithmetic does not help the students acquire a satisfactory knowledge of the subject, why not experiment with advanced courses in the subject that can be offered in the tenth, eleventh, or twelfth grades. Since the students who elect college preparatory courses take mathematics for four years in high schools why should not business students specialize in business mathematics by taking upgraded courses through their four high school years. It seems logical to assume that the reason employers complain about the lack of arithmetical ability on the part of high school business graduates is based on the fact that after the students complete one year or one semester of the subject, only the bookkeeping course gives them a limited opportunity to practice arithmetical calculations outside of those few who are able to study calculating machines. There is such a

thing as a curve of forgetfulness and getting out of practice insofar as speed and accuracy in arithmetical skills is concerned unless the subject is reviewed constantly.

Although one agrees that only capable business arithmetic teachers who are trained in the psychology and methods of the subject should teach the subject it is difficult to understand why it has been proposed that the mathematics departments of high schools be given the assignment of teaching business arithmetic. A business teacher through his special training has the business background and knowledge necessary to make the course functional and alive whereas in the mathematics departments it would simply mean the addition of another course.

As far as the remedial plan of overcoming individual defects is concerned there should be no fault found in making use of that method. However, that plan should be used only to help the pupils surmount their defects and then be returned to their regular classes.

It is the intent of this paper to show that business pupils need a course in business arithmetic by presenting the results of a standardized test given to three business arithmetic classes. A classification of the types and frequency of errors found in the tests will be undertaken and the results will be used as a basis for the construction of a functional course of study in business arithmetic based on the actual needs of three business arithmetic classes.

CHAPTER II

REVIEW OF RELATED LITERATURE

It has often been stated that the decline in the number of schools offering courses in business mathematics may be attributed directly to the fact that teachers of this subject cannot establish a real need for such a course. Research workers have often been advised to determine the proper content of a course of study in mathematics that would suitably prepare the pupil to satisfy the mathematic requirements of his business career. The trend is towards a validation of informational aims rather than operational skills.

In order to select items that would be of the highest importance, a list of business mathematic topics was selected from ten leading textbooks in the subject. The topics were compared with items presented in sales promotional literature, questions in seventeen civil service examinations and topics in six national trade journals. Then the list was sent to fifty Certified Public Accountants for their opinions on the relative importance of the topics that should be included in a course of study for business mathematics.

The list of topics recommended is presented in the order of their importance:

1. Simple interest
2. Inventory taking

3. Assets of business
4. Trade discount
5. Real estate taxes
6. Depreciation of assets
7. Balance sheet
8. Budgeting
9. Annuities
10. Accounts payable
11. Valuation of property
12. Debits
13. Cost of bonds
14. Discounting notes
15. Hour rate system of wages
16. Overhead expenses
17. Bankruptcy
18. Net worth
19. Automobile insurance
20. Bank drafts
21. Freight rates
22. Premium on bonds
23. Cost of transportation
24. Partial payments
25. Bonus
26. Broken line graphs
27. Cash surrender value
28. Real estate brokerage
29. Equations of accounts
30. Divided bar graph
31. Vertical bar graph
32. Duties

The conclusions drawn from the study showed that the value of the items in a business mathematics curriculum can be tested by the degree of validation and by composite ranking presented in the study; that Certified Public Accountants are conservative in their opinions regarding items to be validated since it is evident from their responses that they would rather have an item retained in the commercial mathematical curriculum than have it rejected entirely; that the list of items found in a trade journal furnishes a guide to the mathematics vocabulary requisite for intelligent reading of a trade journal; and that mathematics teachers can determine from the study the

types of graphs which should be taught and emphasized in the classroom because of their social and vocational utility.[1]

Although there has been a great deal of controversy as to the value of teaching business arithmetic in the high school, the question is raised as to whether or not pupils have mastered business applications of arithmetic as a useful tool in fundamental skills and the solving of business problems.

The decreased emphasis on the teaching of arithmetic in the elementary school imposes an enormous additional burden on teaching mathematics in the secondary school. As a result pupils lack arithmetic skills that are fundamental in every day life.

Good teaching practice demands that a standardized arithmetic test be given to pupils when they begin a business arithmetic course in order to find whatever weaknesses the pupils have. Then the effect of training can be measured later by the administration of another standardized test. Such a practice will enable the instructor to see what achievement has been accomplished and will provide a basis for any necessary remedial instruction.

Emphasis should be placed on the solving of problems. The ability of solving problems is necessary for successful adjustment to both vocational and non-vocational business life. Skill in problem solving can be attained only by developing

---

[1] Walter L. Cassidy, "The Commercial Mathematics Curriculum." School Science And Mathematics, 41:571-78, June 1941.

comprehension on the part of the pupils. The pupils should use the following pattern of questions as a guide when they attempt to solve problems: a. What does the problem ask for? b. What would be a reasonable answer? c. What must be done to solve the problem? d. Is the answer reasonable? e. Is the work checked?

When making up or selecting problems for use in a business arithmetic class, avoid misleading facts and procedures, trivialities, useless methods and operations and fantastic business transactions.

The use of business machines in a business arithmetic class provides a strong motivating force. Moreover, machines help pupils increase their speed in performing fundamental operations.[1]

A study was made to see how much business arithmetic students in a collegiate school of business knew. In order to obtain the desired information, a test was given to various groups of students at the College of the City of New York. Pupils entering the College must obtain an average of 80% in their high school subjects.

The general results of the test showed that there was a marked lack of ability among the students in solving problems. The major difficulties met in solving problems was attributed to the following facts: 1. Failure to recognize limitations

---

[1] Clinton M. File, "The Improvement of Business Mathematics." Journal of Business Education, 20:19-20, April 1945.

on the solutions imposed by the conditions of the problem, or to evaluate the answer in terms of such limitations. 2. Failure to check the accuracy of the work. 3. Use of irrelevant data. 4. Use of incorrect reasoning processes. 5. Lack of knowledge of business terms or business computational procedures. Even simple problems proved difficult because of the lack of fundamental knowledges and comprehension of problem data.

Business arithmetic instructors can aid in improving the problem solving ability of their students by emphasizing the following questions in their classroom recitations: 1. What does the problem mean? 2. What is to be found? 3. What data are needed to find the answer? 4. How is the data to be used in finding the answer? 5. If some of the needed data are not given how can they be computed from the given data? 6. What limitations are set by the conditions of the problem on the size of the answer? 7. How can the answer be checked?[1]

The results of a community survey conducted to find out the characteristics of calculations employed in actual business revealed that the calculations were much simpler than might be expected on the basis of textbooks and courses of study in business arithmetic, that most calculations in business are concerned with whole numbers or money, that division is the least

---

[1] Jacob S. Orleans and Emanuel Saxe, "How Much Commercial Arithmetic Do Students in a Collegiate School of Business Know?" Journal of Business Education, 14:14-16, 13-14, 20-22, September - November 1940.

used arithmetic fundamental, and that only a few fractions were used.

The most common business transactions in use, as revealed by the survey were trade discount, simple interest, commission and brokerage, markup and markdown, deferred payments, compound interest, bank discount, insurance, stocks, bonds, and foreign exchange.

In organizing a unit of study in business arithmetic four important factors should be considered: 1. Computation; involving skill in fundamental operations, percentage, and the solution of verbal problems. 2. Information; involving understanding of the language and methods used in business. 3. Function; involving quantitative analysis based on approximate data or estimated plus careful reasoning. 4. Appreciation; involving the importance of the mathematical approach and its use in daily life.[1]

In a series of articles, R. Robert Rosenberg presents several excellent diagnostic tests for use in business arithmetic classes. The tests are lengthy and the problems are numerous, thereby offering considerable opportunity in discovering arithmetical weaknesses of pupils. Moreover, the tests can be used as a basis for corrective and remedial drill and instruction. Individual tests are presented on the subjects common fractions, decimals, interest, bank discount, percentage,

---

[1] H. A. Phillips, "Unit Organization in Business Mathematics." Business Education World, 22:123-24, October 1944.

and trade and cash discount.[1]

It was thought that the attitude of students toward business arithmetic had an effect on their achievement in that subject. Therefore, a class of commercial arithmetic pupils were asked to write what they thought of the subject and how they felt about doing the work.

The attitudes expressed in the essays were compared with the arithmetic achievement of the individual pupils who wrote the essays and a scale was devised.

New pupils were asked to check the scale according to their feeling about business arithmetic. Later comparisons were made and it was found that the scale worked out well as a prognostic indication of success or failure in business arithmetic.

Special attention was centered on the antagonistic pupils. It was found that the offering of downgraded work to the antagonistic pupils aided in changing their attitude towards the subject.[2]

R. Robert Rosenberg stresses the fact that business arithmetic is strictly a vocational subject and that it is a foundation course for most clerical jobs found in an office. He further states that business arithmetic courses should

---

[1] R. Robert Rosenberg, "Diagnostic Tests in Business Mathematics." Business Education World, 25:157-59, 216-17, 278-79, November - January 1945.

[2] Albert L. Billig, "Student Attitude as a Factor in the Mastery of Commercial Arithmetic." The Mathematics Teacher, 23:170-73, April 1944.

emphasize arithmetic fundamentals, short methods, fractions, trading, financing, investments, measurements, and general problems.[1]

An experiment with a business arithmetic class was held to see how much pupils could accomplish when they had to depend upon themselves for study with the teacher offering a minimum of help.

During the first semester the reading approach was used. Pupils were encouraged to find out for themselves and were referred to the textbook whenever the solution to a problem was in the textbook. They were also asked to reread the textbook whenever they did not understand an explanation.

During the second semester the instructor was ready to help and answer every question and request on the part of the pupils. During this semester the class appeared to lose the stamina acquired during the independent first semester. Pupils were quick in adopting the easy way. Nevertheless, pupils should be made to depend upon themselves as much as possible.

The criteria involving the amount of aid to be given to pupils are dependent upon the particular point of the person's potential ability. Sufficient instruction should be given to direct the pupils but the instruction should not be of the type that leaves pupils dependent upon it. Such a policy tends to develop pupil stamina.[2]

---

[1] R. Robert Rosenberg, "What to Teach in Business Arithmetic." Journal of Business Education, 36:75-76, April 1946.

[2] Albert L. Billig, "Approaches in Learning." School And Society, 59:285-87, April 22, 1944.

The objectives of a course in business arithmetic pertaining to problem solving are proposed in this discussion. Pupils should acquire accuracy and speed in the performance of the fundamental processes and they should be able to make intelligent applications of the principles in the solution of problems involving interest, discount, wages, insurance, taxes, graphs and other topics in a business arithmetic course.

Three problems affecting the problem solving ability and suggestions for the efficient solution of the problems are also proposed:

Problem 1. How may mastery of the fundamental principles be obtained without losing the interest of those students who are proficient and still provide a thorough review for pupils poor in elementary mathematics? Remedial and individual instruction can be planned from the results of an inventory test given to the class. Pupils with ability can be given upgraded problems to fit their capabilities and keep up their interest at the same time.

Problem 2. What is the best procedure to follow in guiding student thinking and effort in problem solving? The development of meaningful reading is the best procedure in this case. Pupils should become conscious of the problem and be able to sense the implication. They should be guided to discover all the facts given in the problem, determine what is wanted, and think of the process of solution required. An approximation of the answer should precede the solution and after

the problem is solved the result should be verified.

Problem 3. How may the class use the time at the very beginning of the period so the teacher is free to perform tasks that precede instruction? Introductory drill exercises from the textbook or special drill problems placed on the blackboard before the class meets which are to be worked on as soon as the class enters the room will keep the pupils well occupied until the teacher is ready to begin his class instruction.[1]

In a modern business arithmetic course the following aims should be realized:

1. The attainment of a business standard of accuracy and speed in performing operations with integers, decimals, and fractions.

2. The application of this accuracy and speed in fundamental operations to the solution of practical business problems.

3. The instillation of habits of neatness and arrangement.

4. The inculcation of desirable character traits and right social attitudes and behavior through a study of ethical standards in business practices.

5. The acquisition of a knowledge of essential business forms, terms, practices, and formulas.

6. The development of an appreciation of the application

---

[1] W. Alan Waltham, "Problems of Business Arithmetic." The Contribution of Business Education to Youth Adjustment, Thirteenth Yearbook. Philadelphia, Eastern Commercial Teachers Association, 1940. p 127-34.

of arithmetic to business, home, social, school, and economic functions.

The subject matter of business arithmetic should be related to the everyday needs of tomorrow. Up to date problems using language within the life experiences of the students motivates the teaching of the subject. Practicability and realness of the problems make the subject matter most worthwhile even while the student is attending school. Since the prime motive of education is to prepare the student to live a better life tomorrow, it follows that antiquated subject matter makes the attainment of this goal impossible.

A listing of topics does not make a subject. There should be proper integration within a subject.

The principal cause of failure in arithmetic is due not to the inability to perform fundamental operations but to the lack of understanding caused by the lack of analytical skill and mathematical reading ability in problem solving.

It is desirable that insofar as possible such abstract thinking as is found in simple addition, multiplication, subtraction, division, greatest common divisor, least common multiple, fractions, factoring and percentage should be eliminated as much as possible from a subject planned for the future.

Business arithmetic problems of the future should be based on home management, personal and vocational buying and selling, home ownership, banking, investment, and other similar personal and vocational use topics.

The objectives of future teaching methods will emphasize accuracy, speed, reading skills, work habits, power of concentration, and unadorned reasoning. Further emphasis will be made of vocabulary development pertaining to business terms.

In developing correct habits of attacking business arithmetic problems the following plan should be emphasized when problems are to be solved: The pupil should determine what is to be found, what is given, plan the solution, estimate the result, solve the problem, and check the solution. Problems should be presented to a class in the order of their difficulty.

The teacher of tomorrow will cover twice the ground covered by the teacher of yesterday.[1]

The old tradition of teaching business arithmetic is being followed even to this day and as a result not only secondary students fall short in arithmetical ability but also college graduates.

It is felt that the subject could be made more practical by integrating it with some other business course subjects. Proponents of this method have not made a well controlled study to determine definitely just how much the integration method surpassed the isolation method.

The brush-up method, a semester course given to pupils in the twelfth grade, is resorted to in order to refreshen the

---

[1] Henry M. Smithline, "Relating Business Arithmetic to the Everyday Needs of the Future." Business Education for Tomorrow, Fourteenth Yearbook, Philadelphia, Eastern Commercial Teachers Association, 1941. p 129-32.

arithmetical knowledge of pupils just before they graduate from a secondary school. Nevertheless, there is proof that the present day arithmetic pupil can do better work and that present day teaching is effective.

Levels of arithmetic achievement should be set up in accordance with the position the pupil will occupy when he gets his job. Determining the levels of achievement is a difficult task.

The claim is made that most of the subject matter included in present day business arithmetic courses will never be needed by the majority and it will be forgotten by the remaining small minority before they have occasion to use it. Mental discipline is an unsupportable reason for teaching non-usuable information.

Business arithmetic courses like regular mathematics courses have been constructed from the top downward. The mathematics courses are made to meet requirements laid down by the colleges and the business arithmetic course is made to fit the needs of the employers. Courses of study should be scientifically built from the bottom upwards.[1]

Although the High School Principals' Association in their report of 1940 recommended a revised commercial curriculum and omitted mention of business arithmetic, statements and studies

---

[1] Harold E. Cowan, "Basic Problems in Business Arithmetic." Wartime Problems in Business Education, Sixteenth Yearbook. Philadelphia, Eastern Commercial Teachers Association, 1943. Chapter XX.

made by Dr. Francis T. Spaulding, Dr. Jacob S. Orleans, and Dr. Emanuel Saxe support and prove that there is a need for the teaching of business arithmetic in a secondary school.

Frequent surveys of mercantile establishments show that businessmen are decidedly in favor of more business arithmetic being taught in the secondary schools.[1]

It is recommended that bookkeeping students be required to study a full year of business arithmetic, that all commercial pupils be required to take at least one semester of business arithmetic, and that the subject be made available to all secondary school pupils.

World War II draftees were found to be way below standard in their knowledge of arithmetic fundamentals. The condition shows that the need for arithmetical instruction strongly exists.

There is a very undesirable trend developing whereby the subjects of junior business training and business arithmetic are being taken away from the commercial course. The social science departments feel that junior business training should be taught under their supervision and the mathematics departments would acquire the business arithmetic courses. Such a practice is strongly disapproved and the commercial teachers should strenuously oppose the changes basically on the fact

---

[1] Jerome A. Kramer, "Need for Business Arithmetic." Business and Business Education, Eleventh Yearbook. New York, The Commercial Education Association of the City of New York and Vicinity, 1940-41. p 80-82.

that pupils will be better served when taught junior business training and business arithmetic by business experts, the business teachers.[1]

It is proposed that three different types of business arithmetic courses be made available for secondary school pupils. A ninth year business arithmetic course integrated with business information on the consumer level should be available for all pupils. Another business arithmetic course based on a vocational level should be required of pupils specializing in business subjects. And another refresher course should be provided for business pupils in the twelfth year who fail to give evidence of adequate computational ability on a vocational level.

A review of the current literature and publications pertaining to business arithmetic reveals that the few studies that have been made show pupils attending secondary schools and even colleges lack a satisfactory ability to solve business problems. Such a condition is a positive indication that not enough emphasis is being placed on business arithmetic in the secondary schools.

Since the knowledge attainable through a business arithmetic course is of great value in pupils' future personal contacts with the business world, a need certainly exists for

---

[1] George Goldfarb, "Business Information and Arithmetic for the Consumer." Business and Business Education, Fourteenth Yearbook. New York, The Commercial Education Association of the City of New York and Vicinity, 1943-44. p 3-8.

giving the future citizens a basic knowledge of the computations necessary to become intelligent and efficient users of business facilities. Moreover as time passes by economic conditions become more complex and as a result the need for increased business arithmetic knowledge becomes more essential.

There appears to be a mild trend towards trying to correlate business arithmetic with some other business subject, however, studies must be made to see if such a change will be of value.

There is also a tendency to move the responsibility of teaching business arithmetic from the commercial departments to the mathematics departments. If the mathematics departments can do a better job teaching the subject, it should be taught by members of that department. Nevertheless, the business teacher has the proper training and background to make business arithmetic a functional subject and the subject should remain the responsibility of the commercial department.

Another trend is to eliminate business arithmetic from the secondary school entirely. Such a move would prove disastrous since the subject is a basic course especially for pupils specializing in business courses where a knowledge of business arithmetic is definitely necessary for future bookkeepers, clerks, and salespeople.

CHAPTER III

PROCEDURES IN GATHERING DATA

The following procedures were used in gathering data for the preparation of this report:

1. A survey of literature pertaining to the subject of business arithmetic was made with the objective of discovering the basis of disagreement on the part of business educators as to the value of offering the subject as a basic part of the business courses in high schools.

2. A survey of previous studies was made to discover what has been accomplished in the field of business arithmetic with the aim of finding out if the subject has proved valuable to pupils who have studied a course in business arithmetic.

3. An achievement test in arithmetic was selected with the objective of administering it to groups of pupils taking a course in business arithmetic to discover how their arithmetical age compared with that of other pupils in the nation.

4. The achievement test in arithmetic was administered to three different freshman classes of pupils taking business arithmetic and one class of senior bookkeeping students from which the arithmetical ages of the above mentioned pupils was obtained.

5. A comparison of scores obtained by a freshman group in

the same achievement test administered at the close of the last school month in the elementary school and taken a month after they started a course in business arithmetic in their freshman year at high school was undertaken.

6. An error count was made after the tests were administered to determine the arithmetical weaknesses of the pupils and to use those weaknesses as a basis for preparing the functional course.

7. A survey of several business arithmetic textbooks was made to find out what were the objectives claimed by the authors.

8. A functional course of study in business arithmetic was constructed based on the actual needs of the three business arithmetic classes examined.

After reading a few articles in business education publications on the subject of business arithmetic in which there appeared to be quite a diversity of opinion as to the value of teaching the subject to high school pupils taking the business course, the writer who has taught the subject for several years desired to find out by experimentation with his own classes whether or not there was any scientific basis for the existence of the current controversial issue on teaching business arithmetic. The opinions of various authorities were reviewed and are presented in Chapter I of this study. A digest of the literature studied reveals that there are four divergent schools of thought. One is that business arithmetic should continue to

be taught as a separate course; another is that business arithmetic should be correlated with a bookkeeping course or a junior business training course; and the other is that business arithmetic should be taught as a remedial course.

An extensive search was carried on to obtain the latest information on the subject of business arithmetic. It was surprising to note that a great deal of the suggestions and recommendations pertaining to the subject were based solely on the opinions of the writers. Few studies were based on actual research. That condition is rather unusual because it is not very difficult to obtain actual objective data since pupils can be tested and valid information can thereby be obtained.

There appears to be two extreme points of view insofar as the teaching of business arithmetic is concerned. One point of view is that the subject taught by itself has no value and the other is that the subject can only be taught in a separate course to enable the pupils to acquire arithmetical ability. Another very minor claim is that business arithmetic can be taught successfully in correlation with other business subjects.

If a group is tested and the results indicate a lack of arithmetical ability, it is simple to draw a conclusion that the subject has no value because nothing tangible appears to be achieved. The proponents of no business arithmetic courses fail to note that what the pupils have learned regardless of their achievement is definitely and positively useful in the

student's personal and vocational life. If achievement is not on a high satisfactory plane then the job for teachers, supervisors, and administrators is to concentrate on increasing the rate of achievement. It is safe to assume that more business arithmetic should be offered in the high schools and that the increased emphasis on the subject will be reflected in satisfactory and greater achievement on the part of the pupils.

The Metropolitan Advanced Arithmetic Test (see Appendix A) was used to measure the arithmetical age of the pupils chosen for this study. The test had been used in the local school system for several years and has proved satisfactory. The content of the test is based on courses of study, research studies of content, and widely used textbooks. The selection of questions has been checked carefully to insure satisfactory representation of grade content. All necessary statistical procedures were employed to insure adequate statistical bases for the selection of questions. The test measures what it purports to measure and is valid from the standpoint of content, statistical data, and mechanics of form. The probable error is 2.3 months in arithmetical age for eigth grade pupils which is sufficiently small and sufficiently reliable in almost every instance to measure accurately the achievement status of individual pupils. The tests are objective through three devices: the types of questions used, the directions for scoring, and the scoring keys.

The Metropolitan Advanced Arithmetic Test, form A, was

administered to three business arithmetic classes on the same day. The directions for administering the tests were adhered to minutely. The tests were corrected by the same person and scores and grades were calculated in accordance with grades and norms set up by the authors of the test. Means were calculated for each class separately and then the entire group results were consolidated in order to obtain a mean for the entire group. In this manner the arithmetical age and chronological age of each pupil, each class, and the entire group was obtained. As a result it will be possible to arrange special instruction and attention for pupils who show they need remedial care.

The test was then administered to a senior bookkeeping class with the idea of finding out if they were superior to the freshmen as far as arithmetical ages were concerned. The seniors were given the identical test and their scores were calculated in a similar manner as were the freshman group. The senior group had taken a course of business arithmetic when they were freshmen. Another aim of giving the test to the seniors was to discover what if any arithmetical fundamentals were forgotten so that those fundamentals could be emphasized in the regular business arithmetic course.

The next step was to make some sort of a comparison of test scores. Since the Metropolitan Test is given in the eigth grade of some of our elementary schools before the pupils enter high school, it was possible to compare scores they

obtained in the elementary school with scores they obtained after studying the subject for five weeks at the high school. While it was possible to obtain previous records of only twenty five pupils of the seventy-two actually tested, the results of the comparison were encouraging in so far as improvement in arithmetical age was concerned.

Following the grading and scoring of tests an actual count was made of the problems answered correctly, those answered incorrectly, and those omitted. (The report of the error count is presented in tabular form in Chapter IV.) Each problem was diagnosed as to the type of arithmetical function necessary to solve the problem. The objective of the error count is to determine the weaknesses of pupils in arithmetical fundamentals and to provide remedial measures for those deficiencies.

The next step was to determine exactly the objectives of a business arithmetic course. In order to obtain a consensus of opinion on objectives, several business arithmetic textbooks published from 1924 to 1944 were inspected. The objectives of business arithmetic set forth by the authors of the textbooks were examined, extracted, and consolidated. These objectives were classified according to their social, personal, and vocational values. It was felt necessary to determine the objectives of a course in business arithmetic to help prove the necessity and value of the course.

The objectives of a course in business arithmetic thought most desirable are classified and offered as follows:

SOCIAL OBJECTIVES

1. To develop an appreciation of the application and usefulness of business arithmetic in business, home, social, and economic functions.

2. To inculcate desirable character traits and proper social attitudes and behavior through a study of ethical standards in business.

PERSONAL OBJECTIVES

1. To provide a basis for the application of business arithmetic to the practical and personal problems found in the major fields of an individual's daily activities whether in the home, school, society, or business.

2. To acquire a knowledge of the principles governing business calculations, together with a reasonable degree of skill in the use of such principles and to bring every principle that is taught within the student's comprehension.

3. To provide a basis for the knowledge of essential business forms, terms, and practices.

4. To develop the ability to make many ordinary computations mentally.

5. To develop habits of systematic procedure, neatness, and arrangement that will tend to carry over in everything the pupil does.

VOCATIONAL OBJECTIVES

1. The attainment of a business standard of accuracy and speed in performing fundamental operations with integers,

decimals, fractions, and mixed numbers.

2. To acquire permanent learning of arithmetical operations essential to success in business.

3. To develop skill in writing legible figures, arranging computations systematically and labeling results.

4. To develop skill in reading, interpreting and solving practical word problems.

5. To develop skill in the use of time-saving practical short cuts in figuring.

6. To emphasize dexterity in mental computations.

7. To develop a business vocabulary.

CHAPTER IV

ANALYSIS AND INTERPRETATION OF DATA

The results of the Metropolitan Advanced Arithmetic Test administered to the pupils for the purposes of this study are presented as follows:

TABLE I

SCORES OF THE METROPOLITAN ADVANCED ARITHMETIC TEST ADMINISTERED TO 20 NINTH GRADE PUPILS IN A BUSINESS ARITHMETIC CLASS AT THE CLASSICAL AND HIGH SCHOOL IN SALEM, MASSACHUSETTS

Pupil	Score	Grade Equivalent	Age Equivalent	Chronological Age
1	73	9.3	14-8	13-11
2	67	8.7	14-1	14-6
3	66	8.6	14-0	13-6
4	66	8.6	14-0	14-2
5	64	8.4	13-10	14-1
6	64	8.4	13-10	14-8
7	61	8.1	13-7	15-6
8	60	8.0	13-6	14-10
9	58	7.8	13-4	14-4
10	57	7.7	13-2	14-10
11	55	7.5	13-0	13-11
12	54	7.4	12-11	13-4
13	54	7.4	12-11	14-6
14	53	7.3	12-10	16-4
15	48	6.8	12-4	14-1
16	47	6.7	12-3	15-0
17	45	6.5	12-1	14-5
18	44	6.4	12-0	15-0
19	41	6.1	11-8	15-3
20	36	5.6	11-1	15-2
S. D.	9.7			
Mean	56.0	7.6	13-1	14-5

The average or mean score for the class recorded in Table I

was 56 points. This is equivalent to the score a pupil in an elementary school in the seventh grade should get after he completes 6 months of training in that grade. The 56 points also indicates an arithmetic age of 13 years and 1 month.

Comparing results with norms for the test, this class should average a grade equivalent of 9.1 and an age equivalent of 14 years and 6 months. The results reveal, however, an average deficiency of 15 points in their scores, and 1 year and 4 months in their arithmetic ages. Their chronological ages average 16 months more than their arithmetical ages. These figures show that there is a strong need of additional arithmetic instruction and study to bring this class up to a relatively standard achievement.

The average or mean score for the class recorded in Table II was 60 points. This is equivalent to the score a pupil in an elementary school in the eighth grade should get after he completes 1 month of training in that grade. The 60 points also indicates an arithmetical age of 13 years and 6 months.

Comparing the results with norms for the test, this class should average a grade equivalent of 9.1 and an age equivalent of 14 years and 6 months. The results reveal, however, an average deficiency of 11 points in their scores and one year in their arithmetic ages. Their chronological ages average 11 months more than their arithmetical ages. Although this class attained a higher score than the class recorded in Table I, the results add to the fact that a definite need for additional

arithmetic instruction and study exists.

TABLE II

SCORES OF THE METROPOLITAN ADVANCED ARITHMETIC TEST ADMINISTERED TO 21 NINTH GRADE PUPILS IN A BUSINESS ARITHMETIC CLASS AT THE CLASSICAL AND HIGH SCHOOL IN SALEM, MASSACHUSETTS

Pupil	Score	Grade Equivalent	Age Equivalent	Chronological Age
1	73	9.3	14-8	13-9
2	71	9.1	14-6	14-1
3	71	9.1	14-6	14-10
4	68	8.8	14-3	15-1
5	66	8.6	14-0	13-6
6	65	8.5	13-11	16-0
7	64	8.4	13-10	13-8
8	63	8.3	13-9	14-2
9	63	8.3	13-9	14-6
10	62	8.2	13-8	13-6
11	62	8.2	13-8	14-10
12	61	8.1	13-7	15-2
13	60	8.0	13-6	15-3
14	56	7.6	13-1	15-6
15	55	7.5	13-0	15-8
16	55	7.5	13-0	13-10
17	54	7.4	12-11	14-9
18	53	7.3	12-10	15-10
19	50	7.0	12-7	15-10
20	40	6.0	11-7	13-0
21	40	6.0	11-7	13-7
S. D.	8.6			
Mean	60.0	8.0	13-6	14-5

The average or mean score for the class recorded in Table III was 58 points. This is equivalent to the score a pupil in an elementary school in the seventh grade should get after he completes eight months of schooling in that grade. The 58 points also indicates an arithmetical age of thirteen years and four months.

Comparing the results with norms for the test, this class

should average a grade equivalent of 9.1 and an age equivalent of 14 years and 6 months. The results reveal, however, an average deficiency of 13 points in their scores and 1 year and 2 months in their arithmetic ages. Their chronological ages

TABLE III

SCORES OF THE METROPOLITAN ADVANCED ARITHMETIC TEST ADMINISTERED TO 31 NINTH GRADE PUPILS IN A BUSINESS ARITHMETIC CLASS AT THE CLASSICAL AND HIGH SCHOOL IN SALEM, MASSACHUSETTS

Pupil	Score	Grade Equivalent	Age Equivalent	Chronological Age
1	74	9.4	14-9	14-3
2	72	9.2	14-7	13-7
3	71	9.1	14-6	14-2
4	69	8.9	14-4	14-5
5	68	8.8	14-3	14-3
6	67	8.7	14-1	14-2
7	67	8.7	14-1	14-8
8	66	8.6	14-0	13-10
9	66	8.6	14-0	14-4
10	63	8.3	13-9	13-4
11	62	8.2	13-8	13-4
12	62	8.2	13-8	14-0
13	61	8.1	13-7	16-0
14	61	8.1	13-7	13-5
15	61	8.1	13-7	14-8
16	60	8.0	13-6	13-8
17	58	7.8	13-4	15-2
18	58	7.8	13-4	13-11
19	56	7.6	13-1	13-6
20	55	7.5	13-0	14-6
21	54	7.4	12-11	16-2
22	54	7.4	12-11	16-2
23	54	7.4	12-11	14-10
24	54	7.4	12-11	15-3
25	50	7.0	12-7	15-3
26	49	6.9	12-6	14-4
27	46	6.6	12-2	15-0
28	44	6.4	12-0	14-7
29	44	6.4	12-0	14-3
30	40	6.0	11-7	14-4
31	35	5.5	11-0	14-0
S. D.	9.7			
Mean	58.0	7.8	13-4	14-4

average 12 months more than their arithmetic ages. Although this class made a higher average score than the group recorded in Table I and not as high an average score as the group recorded in Table II, the results again show that a definite need exists for additional arithmetic instruction and study on the part of pupils taking a business arithmetic course in a high school.

TABLE IV

COMBINED SCORES OF THE METROPOLITAN ADVANCED ARITHMETIC TEST ADMINISTERED TO 72 NINTH GRADE PUPILS IN THREE BUSINESS ARITHMETIC CLASSES AT THE CLASSICAL AND HIGH SCHOOL IN SALEM, MASSACHUSETTS

Pupil	Score	Grade Equivalent	Age Equivalent	Chronological Age
1	74	9.4	14-9	14-3
2	73	9.3	14-8	13-9
3	73	9.3	14-8	13-11
4	72	9.2	14-7	13-7
5	71	9.1	14-6	14-1
6	71	9.1	14-6	14-10
7	71	9.1	14-6	14-2
8	69	8.9	14-4	14-5
9	68	8.8	14-3	14-3
10	68	8.8	14-3	15-1
11	67	8.7	14-1	14-2
12	67	8.7	14-1	14-8
13	67	8.7	14-1	14-6
14	66	8.6	14-0	13-6
15	66	8.6	14-0	13-6
16	66	8.6	14-0	14-2
17	66	8.6	14-0	13-10
18	66	8.6	14-0	14-4
19	65	8.5	13-11	16-0
20	64	8.4	13-10	14-1
21	64	8.4	13-10	14-8
22	64	8.4	13-10	13-8
23	63	8.3	13-9	14-2
24	63	8.3	13-9	14-6
25	63	8.3	13-9	13-4
26	62	8.2	13-8	13-4

TABLE IV
(continued)

Pupil	Score	Grade Equivalent	Age Equivalent	Chronological Age
27	62	8.2	13-8	14-0
28	62	8.2	13-8	13-6
29	62	8.2	13-8	14-10
30	61	8.1	13-7	16-0
31	61	8.1	13-7	13-5
32	61	8.1	13-7	14-8
33	61	8.1	13-7	15-2
34	61	8.1	13-7	15-6
35	60	8.0	13-6	14-10
36	60	8.0	13-6	15-3
37	60	8.0	13-6	13-8
38	58	7.8	13-4	15-1
39	58	7.8	13-4	13-11
40	58	7.8	13-4	14-4
41	57	7.7	13-2	14-10
42	56	7.6	13-1	13-6
43	56	7.6	13-1	15-6
44	55	7.5	13-0	15-8
45	55	7.5	13-0	13-10
46	55	7.5	13-0	16-2
47	55	7.5	13-0	13-11
48	54	7.4	12-11	14-6
49	54	7.4	12-11	13-4
50	54	7.4	12-11	14-6
51	54	7.4	12-11	16-2
52	54	7.4	12-11	14-10
53	54	7.4	12-11	15-3
54	54	7.4	12-11	14-9
55	53	7.3	12-10	16-4
56	53	7.3	12-10	15-10
57	50	7.0	12-7	15-10
58	50	7.0	12-7	15-3
59	49	6.9	12-6	14-4
60	48	6.8	12-4	14-1
61	47	6.7	12-3	15-0
62	46	6.6	12-2	15-0
63	46	6.6	12-2	14-7
64	45	6.5	12-1	14-5
65	44	6.4	12-0	14-3
66	44	6.4	12-0	15-0
67	41	6.1	11-8	15-3
68	40	6.0	11-7	13-0
69	40	6.0	11-7	13-7
70	40	6.0	11-7	14-4

[illegible]

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TABLE IV
(concluded)

Pupil	Score	Grade Equivalent	Age Equivalent	Chronological Age
71	36	5.6	11-1	15-2
72	35	5.5	11-0	14-0
S. D.	9.4			
Mean	58.0	7.8	13-4	14-5

The average or mean score for the group of 72 pupils who took the test was 58 points. This is equivalent to the score a pupil in an elementary school in the seventh grade should get after he completes eight months of arithmetic instruction in that grade. The 58 points also indicates an arithmetical age of thirteen years and four months.

Comparing the results with norms for the test, this group should average a grade equivalent of 9.1 and an arithmetical age equivalent of 14 years and 6 months. The results reveal, however, an average deficiency of 13 points in their scores and one year and two months in their arithmetic ages. Again the results clearly indicate the need for special arithmetic instruction for high school pupils and especially those who elect business courses where arithmetical knowledge and skill is necessary for success in business studies.

Although the number of cases listed in Table V is limited, the results are offered to show an indication of improvement or retainment of arithmetical knowledge in so far as bookkeeping students who took a course in business arithmetic in their freshman year and have been using arithmetic in their study of

bookkeeping are concerned.

The average or mean score for the group recorded in Table V is 61 points. This is equivalent to the score an elementary school pupil in the eighth grade should get after he completes one month of arithmetic instruction in that grade. The 61 points also indicates an arithmetical age of 13 years and 7 months.

TABLE V

SCORES OF THE METROPOLITAN ADVANCED ARITHMETIC TEST ADMINISTERED TO 15 TWELFTH GRADE PUPILS IN A BOOKKEEPING CLASS AT THE CLASSICAL AND HIGH SCHOOL IN SALEM, MASSACHUSETTS

Pupil	Score	Grade Equivalent	Age Equivalent	Chronological Age
1	81	10.1	15-4	16-6
2	73	9.3	14-8	17-9
3	68	8.8	14-3	16-11
4	67	8.7	14-1	16-4
5	66	8.6	14-0	17-10
6	61	8.1	13-7	16-6
7	60	8.0	13-6	16-7
8	60	8.0	13-6	17-5
9	59	7.9	13-5	16-6
10	56	7.6	13-1	17-0
11	55	7.5	13-0	17-0
12	54	7.4	12-11	16-11
13	54	7.4	12-11	17-0
14	51	7.1	12-8	16-11
15	51	7.1	12-8	17-0
S. D.	8.4			
Mean	61.0	8.1	13-7	17-0

Comparing the results with norms for the test, the group recorded in Table V should average a grade equivalent of twelve years and an arithmetical age of seventeen years. To attain that score, however, pupils would have to solve every one of

the 100 problems in the test correctly and that without question is highly improbable.

The results show, however, that this group averaged three points higher than the freshman group when they should have attained a considerably higher gain. The indication shows that the bookkeeping students should be given some concentrated arithmetic instruction as part of their course to keep them from forgetting the fundamentals they previously learned. It was also noted that this group was more successful than the freshman group in solving reasoning problems.

The figures in Table VI were gathered to see if there was any definite indication of improvement when pupils continued their arithmetic study in a business arithmetic course at high school. The results show a marked and positive improvement in the subject. Scores were obtained from the same type test that was given to the pupils in the last month of their eighth grade and again after the first six weeks of instruction in a business arithmetic course. The average or mean gain in arithmetical age was six months which appears to be a marked indication of the value of taking a special course in the subject.

Results of tests taken by 25 members of the freshman group were compared with results of the same tests taken by the same pupils four months before the present tests were administered while those pupils were in the eighth grade.

The comparison is presented in Table VI.

TABLE VI

COMPARATIVE SCORES OF THE METROPOLITAN ADVANCED ARITHMETIC TEST ADMINISTERED TO 25 PUPILS IN THE EIGHTH GRADE AND ADMINISTERED FOUR MONTHS LATER TO THE SAME PUPILS IN THE NINTH GRADE WHILE MEMBERS OF A BUSINESS ARITHMETIC CLASS AT THE CLASSICAL AND HIGH SCHOOL IN SALEM, MASSACHUSETTS

Pupil	Grade Score June, 1946	Grade Score October, 1946	Increase	Decrease
1	9.4	9.4	0.0	0
2	9.0	9.3	0.3	0
3	8.8	9.1	0.3	0
4	8.6	8.6	0.0	0
5	8.3	8.7	0.4	0
6	8.2	8.6	0.4	0
7	8.2	8.7	0.5	0
8	8.0	8.4	0.4	0
9	7.9	8.6	0.7	0
10	7.9	8.1	0.2	0
11	7.7	8.0	0.3	0
12	7.7	8.6	0.9	0
13	7.7	7.8	0.1	0
14	7.6	7.7	0.1	0
15	7.4	8.7	1.3	0
16	7.4	8.4	1.0	0
17	7.3	7.3	0.0	0
18	7.3	8.1	0.8	0
19	7.2	7.5	0.3	0
20	7.0	7.5	0.5	0
21	7.0	8.3	1.3	0
22	6.9	8.1	1.2	0
23	6.9	7.8	0.9	0
24	6.5	6.5	0.0	0
25	6.4	7.4	1.0	0
S. D.	0.73	0.69	0.41	
Mean	7.67	8.20	0.50	0

The tabulation of problems correct, incorrect, and omitted was undertaken to determine arithmetic fundamentals in which pupils showed a deficiency. The totals from Table VII show that 44.34% of the problems were solved correctly, 30.75% were computed incorrectly, and 24.91% were omitted.

TABLE VII

A TABULATION OF PROBLEMS IN THE METROPOLITAN ADVANCED ARITHMETIC TEST SHOWING THE NUMBER OF PROBLEMS SOLVED CORRECTLY, THE NUMBER OF PROBLEMS COMPUTED INCORRECTLY AND THE NUMBER OF PROBLEMS OMITTED BY 72 NINTH GRADE PUPILS OF THREE BUSINESS ARITHMETIC CLASSES AT THE CLASSICAL AND HIGH SCHOOL IN SALEM, MASSACHUSETTS

Problem	Type Part I Arithmetic Fundamentals	Correct	Wrong	Omitted
1	Addition	53	19	0
2	Subtraction	59	11	2
3	Multiplication	42	29	1
4	Division	59	11	2
5	Division	45	25	2
6	Addition of fractions	63	7	2
7	Addition of fractions	53	16	3
8	Addition of fractions and mixed nos.	42	26	4
9	Sub. of fractions and mixed numbers	65	5	2
10	Subtraction of fractions	62	8	2
11	Sub. mixed numbers and fractions	35	33	4
12	Sub. mixed numbers and fractions	37	28	7
13	Multiplication of fractions	57	12	3
14	Multiplication of fractions	51	12	9
15	Mult. of mixed numbers and fractions	45	19	8
16	Division of mixed nos. and fractions	57	10	5
17	Division of fractions	53	11	8
18	Div. of fractions and whole numbers	32	31	9
19	Div. of fractions and whole numbers	54	9	9
20	Addition of decimals	61	11	0
21	Addition of decimals and fractions	3	55	14
22	Addition of decimals and whole numbers	39	23	10
23	Addition of decimals and whole numbers	51	18	3
24	Subtraction of decimals	47	20	5
25	Subtraction of fractions and decimals	20	33	19
26	Mult. of whole numbers and fractions	63	8	1
27	Mult. of whole numbers and fractions	49	20	3
28	Div. of whole numbers and decimals	60	11	1
29	Division of decimals	40	29	3
30	Division of decimals	41	25	6
31	Graphs	63	3	6
32	Graphs	18	46	8
33	Graphs	63	2	7
34	Percentage	44	19	9
35	Percentage	42	16	14
36	Percentage	37	22	13
37	Percentage	29	27	16
38	Measurements	8	37	27

TABLE VII
(continued)

Problem	Type Part I Arithmetic Fundamentals	Correct	Wrong	Omitted
39	Measurements	58	3	11
40	Measurements	12	41	19
41	Weights	34	28	10
42	Weights	34	24	14
43	Measurements	25	24	23
44	Graphs	4	44	24
45	Graphs	38	21	13
46	Graphs	6	48	18
47	Square area	46	10	16
48	Square area	18	34	20
49	Square area	34	16	22
50	Triangular area	3	29	40
51	Triangular area	9	15	48
52	Average	26	31	15
53	Commission and percentage	34	17	21
54	Interest and percentage	10	25	37
55	Discount and percentage	2	33	37
56	Interest, 60-day method	0	21	51
57	Taxation, division and decimals	3	19	50
58	Equations	10	12	50
59	Equations	3	11	58
60	Equations	1	10	61
	Part II Arithmetic Problems			
1	Liquids	41	23	8
2	Division	52	14	6
3	Division and multiplication	48	19	5
4	Division and subtraction	35	25	12
5	Multiplication of fractions	55	10	7
6	Profit and loss	47	21	4
7	Division	45	19	8
8	Liquid measure	49	17	6
9	Multiplication and subtraction	48	23	1
10	Addition of fractions	50	17	5
11	Subtraction of fractions	58	8	6
12	Multiplication	31	36	5
13	Subtraction of fractions	35	27	10
14	Add. and multiplication of fractions	41	23	8
15	Division of fractions	20	32	20
16	Division and multiplication	16	35	21
17	Subtraction of decimals	30	27	15
18	Averages	47	21	4
19	Addition of fractions	15	36	21
20	Multiplication of fractions	26	32	14
21	Measurements, multiplication	2	55	15
22	Averages, division	52	12	8

TABLE VII
(concluded)

Problem	Type Arithmetic Problems	Correct	Wrong	Omitted
23	Weights, subtraction	35	26	11
24	Area, multiplication	10	38	24
25	Proportion, multiplication	13	34	25
26	Percentage	29	29	14
27	Average	35	24	13
28	Measurements, area	0	26	46
29	Measurements, area	1	24	48
30	Measurements, area	0	32	40
31	Measurements, perimeter	0	30	42
32	Proportion	26	14	32
33	Taxes	16	16	40
34	Discount series	8	26	38
35	Interest, percentage	0	18	54
36	Triangular measure	0	13	59
37	Interest, 60-day method	16	16	40
38	Commission, percentage	0	18	54
39	Fractions, stocks	0	12	60
40	Division and multiplication	9	23	40
Totals		3193	2214	1793
Mean		31.93	22.14	17.93
Percentages		44.34%	30.75%	24.91%

The time limit accounts for the great number of problems omitted in the latter part of the test but when the percentage of incorrect problems is compared with the percentage of correct problems a high percentage of 40% representing the incorrect problems exists. Obtaining the correct answers for six out of ten problems attempted is not a satisfactory achievement for arithmetic pupils.

Outstanding weaknesses were revealed in multiplication and division, subtraction of fractions, subtraction of mixed numbers, division of fractions and mixed numbers, addition of decimal fractions, mixed numbers and whole numbers, graph readings,

percentage, measurements, weights, area computations, averages, interest and discount. In the problem section, weaknesses were revealed in problems where computations had to be made in weights and measurements, combinations of multiplication and division, combinations of multiplication and subtraction, simple multiplication computations, all types of fractional operations, percentages, area computations, discount, and interest.

CHAPTER V

FINDINGS AND RECOMMENDATIONS

FINDINGS

1. The mean arithmetical age of a class of 72 high school freshmen taking a course in business arithmetic after one month's instruction in the course was 13 years and 4 months. According to norms set up in the Metropolitan Advanced Arithmetic Test used in this study, ninth grade pupils after completing 1 month of arithmetic study should attain a mean arithmetical average of 14 years and 6 months. Therefore, a mean arithmetical age deficiency of 1 year and 2 months was shown by this group.

2. The mean arithmetical age of 15 high school seniors taking a third year bookkeeping course after one month's instruction in the course was 13 years and seven months. Although their mean arithmetical age was only 3 months higher than that of the freshman group, the results indicate no loss of arithmetical ability in so far as this class was concerned.

3. Freshmen pupils taking a course in business arithmetic show a marked indication of improvement in arithmetical age shortly after they start such a course at high school. The scores of 25 pupils of the freshman group tested were compared with the scores those pupils attained when they took the test a month before they entered high school. The comparison showed

a mean increase of 5 months in arithmetical age.

4. Pupils tend to retain their arithmetical knowledge. In the comparison of scores made by the freshmen who took the tests at the close of the eighth grade and after the beginning of the ninth grade, none of them showed any decrease in arithmetical age, four showed no change in arithmetical age, and the remaining twenty-one showed increases in arithmetical ages ranging from one month to one year and three months.

5. There is a need for a business arithmetic course as a basic part of a commercial course. Since a comparison of scores indicates a marked improvement on the part of pupils studying a course in business arithmetic and the results of the tests show a below average arithmetic age, it is logical to assume that a business arithmetic course will enable the pupils to improve their arithmetical ability and retain what they have learned.

6. Pupils reveal a marked weakness in calculating arithmetical fundamentals and solving arithmetic problems. The error count shows that 60% of the problems attempted by the pupils were solved correctly.

7. Outstanding weaknesses were revealed in arithmetic fundamentals involving multiplication and division, subtraction of fractions from mixed and whole numbers, division of fractions and mixed numbers, addition of decimal fractions, mixed numbers and whole numbers, subtraction of fractions and decimals, graph readings, percentage, interest, discount, averages,

area computations, weights and measurements.

8. Outstanding weaknesses were revealed in arithmetic problems involving combinations of arithmetic fundamentals such as division and multiplication, multiplication and subtraction, fractional operations, area computations, percentages, interest, discount, weights and measurements.

CURRICULUM CHANGES RECOMMENDED

1. Every student taking the commercial course should be required to take a full year of study in business arithmetic in the ninth grade.

2. Students specializing in a commercial clerical course should continue their business arithmetic study as part of the clerical practice course throughout the tenth, eleventh, and twelfth grades.

3. Students specializing in bookkeeping should have one class period a week of their bookkeeping course devoted to a constant review of arithmetic throughout the tenth and eleventh grades. These pupils should also be given a semester of review business arithmetic and another semester of business mathematics in their twelfth year.

4. Students specializing in stenography should be required to take a semester of review business arithmetic in their twelfth year.

5. Students specializing in retailing should also, like the clerical group, be made to continue their business arithmetic study as part of their retailing courses.

Boston University
School of Education
Library

6. Students who are planning to continue their business education at colleges and universities in the field of business administration and accounting should be given upgraded courses in business arithmetic and business mathematics beginning in the ninth year and continuing through the twelfth year. In the ninth year emphasis should be placed on arithmetical fundamentals and simple problem solving. In the tenth year emphasis should be placed on the mastery of fundamentals and the ability to solve common practical problems based on actual business transactions. In the eleventh year emphasis should be placed on advanced type problems involving the use of algebra in their solutions. In the twelfth year emphasis should be placed on the use of logarithms and the slide rule, and the solving of problems faced by beginning accountants. The background acquired by studying the proposed courses would aid considerably in preparing business students for the complicated accounting and business mathematics that a beginning student would meet in a college or university.

DESIRABLE TEACHER QUALIFICATIONS

A business arithmetic teacher should have a business education background and have a thorough knowledge of the subject. The teaching of business arithmetic can be made interesting and functional by a teacher who can correlate the subject with the uses and practices of arithmetic as it relates to actual office work. Mastery of the subject matter enables the instructor to show pupils how to make the computations quickly and accurately.

An intense interest in teaching the subject on the part of the teacher is a desirable qualification. A knowledge of the psychology of teaching arithmetic and familiarity with practical teaching methods are highly desirable qualifications but to those qualifications must be added the mastery of subject matter.

RECOMMENDATIONS FOR CLASS PROCEDURE

A teacher should always have a plan before teaching an arithmetic class. He must have an idea of the work to be taught, how he intends to present the work, and what the assignment for the next lesson will be. This plan can consist of a few short written statements since a formal plan that takes a great deal of time to prepare can be made worthless merely by a question from one of the pupils and the time spent in preparing the plan is wasted. It would be better to jot down and keep a record of what has been accomplished after the class meets.

An arithmetic class can and should be kept alive and moving continuously throughout the period. The motto should be "everyone working all the time". Questions should be stated so every pupil will think he will be called upon and thereby will be thinking of the answer. When pupils are sent to the blackboard, pupils at the desks should be made to solve the same problems or other problems so time will not be wasted watching another person work.

At the beginning of the class period several simple

problems involving different fundamental processes should be placed on the board and the pupils should be made to solve the problems as soon as they enter the classroom. The few minutes required to solve the problems will enable the instructor to take attendance and do whatever other administrative chores are necessary. Then a few minutes of the class time can be taken to check the answers of the preliminary problems. The papers should be exchanged and corrected by the pupils. Such a practice will create a mild competitive spirit among the pupils besides offering a constant review of arithmetic fundamentals throughout the course and tends to overcome the harmful effects of teaching a new fundamental and neglecting that fundamental after devoting a few periods to it.

Special attention should be given towards obtaining quick responses from the pupils. This practice helps keep the pupils alert and at the same time gives them practice in making rapid mental and written computations.

The writing of legible figures should never be neglected since poorly written figures are sources of many errors.

Every business arithmetic class should be equipped with a few calculating machines. There is a certain amount of drudgery in adding long columns of figures and making calculations involving extensive multiplications and divisions. The pupils should be able to do the necessary work involved in extensive computations but they also should know that there are machines available that will help make those tedious columns

add up easily. Moreover, the ability to use calculating machines is of immense value when the pupils look for employment and the acquisition of an appreciation of the value of saving time is an asset when they take part in business life.

BASIC REQUIREMENTS FOR A COURSE OF STUDY IN BUSINESS ARITHMETIC.

A course in business arithmetic should be organized so that the pupils will acquire a sound working knowledge of arithmetical fundamentals. The fundamentals, however, should be applied to practical problems in order that the usefulness of the fundamentals taught can be related to live situations. Drill in fundamental processes until accurate automatic responses can be obtained from the pupils is desirable, but without comprehension the automatic responses are worthless when the pupil is faced with a problem that requires reasoning applications. Therefore, mastery of fundamentals plus the ability to apply the fundamentals in solving practical problems should be the major objectives of a course of study in business arithmetic.

The improved course of study should be built upon definiteness and flexibility. The terms of the course must be definite in what is expected to be taught and accomplished. Minimum achievements expected must be stated and the use of standardized tests to measure the achievement should be made. The teacher should be permitted to adjust the topics to the class thereby providing for individual differences among students. When definiteness and flexibility are present, the teacher can do creative work and obtain excellent results from his pupils.

The topics that should be covered as the minimum essentials in the subject matter of a business arithmetic course are presented as follows:

1. Systems of notation
2. Fundamental processes
3. Fractions
4. Aliquot parts
5. Pay rolls
6. Denominate numbers
7. Percentage
8. Trade and cash discount
9. Profit and loss
10. Marking goods
11. Depreciation
12. Commission and brokerage
13. Compound and accurate interest
14. Negotiable instruments
15. Partnership
16. Installment buying
17. Taxation
18. Insurance, fire and life
19. Stocks and bonds
20. Graphs
21. Practical measurements
22. Real estate
23. Invoices and statements
24. Savings banks

A basic textbook in business arithmetic is essential for efficient and constructive classroom work. If the textbook is dispensed with, much inefficiency and wasted time result from dictating, mimeographing, copying, and writing on the blackboard. The modern textbook should provide for motivation and for individual differences. It should contain language suitable to the age and grade of the student and should conform to business practices. It is false economy to keep textbooks in use until they fall apart from old age when new and revised modern books are available at moderate cost. New books are a source of motivation for the pupils and a challenge to the

teacher who has to revise his course of study to fit the new textbook.

CONCLUSIONS:

1. Pupils reveal a marked weakness in calculating arithmetical fundamentals and solving arithmetic problems.

2. Pupils tend to retain their arithmetical ability.

3. There is no indication of loss in arithmetic age after pupils complete a course in business arithmetic.

4. There is a marked indication of increase in arithmetic age while pupils are taking a course in business arithmetic.

5. There is a decided need for a business arithmetic course in the secondary schools that should be available to all pupils.

6. The business arithmetic course must be a basic part of the commercial course.

7. A planned and functional course of study will serve better the needs of the high school students in business arithmetic classes.

A FUNCTIONAL COURSE OF STUDY

ADDITION

Addition is the most commonly used and most important fundamental arithmetic process. It consists of finding the sum of two or more numbers known as addends. The total of the addends equals the sum.

In the treatment of this topic the following outline is presented to help build up and refresh the arithmetical knowledge of pupils.

1. Introduction.
   - a. Importance of addition and need for the development of accuracy and speed in adding.
2. Addition combinations for class drills.
   - a. Forty-five two-figure combinations.
   - b. One hundred sixty-five three-figure combinations.
3. Skill development.
   - a. Do not lose place in the column of figures.
   - b. Add all columns and stay in the proper column.
   - c. Write down the right-hand figure and carry the other one.
   - d. Group figures by tens.
     - (1) Recognize immediately two or more numbers that total ten.
   - e. Copy correct figures.
   - f. Write uniform and legible figures.
   - g. Write figures in straight columns.

    - h. Break up long columns.
- 4. Checking addition.
    - a. Reverse order.
    - b. Civil service, accountants, or column addition method.
    - c. Casting out nines or casting out elevens.
- 5. Teaching emphasis.
    - a. Dictate figures for pupils to write.
    - b. Supply mental drill
        - (1) Start with a number and have pupils add a number until they reach a specified number.
        - (2) Rapid calculation.
- 6. Type of business arithmetic problems to use.
    - a. Horizontal and vertical addition involving columnar sales reports.
    - b. Deposit tickets.
    - c. Making change.
    - d. Regular columns of figures using dollars and cents designations.

SUBTRACTION

Subtraction is the process of finding how much one number exceeds the other. The number from which we subtract is called the minuend and the number subtracted is called the subtrahend, the result is the difference. Subtraction is used principally in making change and finding balances of accounts.

1. Introduction.

- a. Importance of subtraction and need for the development of accuracy and speed in that process.

2. Subtraction combinations for class drills.
   - a. Use the forty-five two-figure combinations.
3. Skill development.
   - a. Understand how to borrow from the minuend when the subtrahend figure is larger.
   - b. Understand how to borrow across a zero from the minuend.
   - c. Take away method.
   - d. Difference method.
   - e. Additive method.
4. Checking subtraction.
   - a. Add difference to the subtrahend to equal the minuend.
   - b. Subtract the difference from the minuend to give the subtrahend.
   - c. Add the remainder to the subtrahend, the result should equal the minuend.
5. Teaching emphasis.
   - a. Dictate figures.
   - b. Supply mental drill.
     - (1) Use retrogressive method. Start with a number and keep subtracting a specified number until nothing else can be subtracted.
   - c. Rapid calculation.

6. Types of business arithmetic problems to use.
    a. Horizontal subtraction.
    b. Cash accounts.
    c. Check book stubs.
    d. Bank reconciliation statements.
    e. Finding net sales and net proceeds.
    f. Financial statements.

MULTIPLICATION

Multiplication is the process of increasing one number as many times by itself as there are units in another number. Multiplication is abbreviated addition. The number being multiplied is called the multiplicand. The number being used to multiply is known as the multiplier and the result of the multiplication is called the product. The multiplicand and the multiplier are also commonly called factors of the product.

1. Introduction.
    a. Importance of the multiplication operation and need for the development of accuracy and skill in that process.
2. Multiplication combinations for class drill.
    a. Use of the 45 two-figure combinations for oral drill.
3. Skill development.
    a. In multiplying always write the right hand number of the product directly under the number which is multiplied.
4. Checking multiplication.

    - a. Estimate answers before carrying out the operation.
    - b. Reverse factors and multiply.
    - c. Casting out nines.
5. Important short methods.
    - a. To multiply by 10, 100, 1000, etc., move the decimal point to the right as many places as there are ciphers in the multiplier.
    - b. To multiply a number by 50, move the decimal point two places to the right and divide by two.
    - c. To multiply a number by 25, move the decimal point two places to the right and divide by four.
    - d. To multiply by 11, multiply the number by 10 and add the number to the result.
    - e. To multiply by 101 or 99, multiply by 100 and add or subtract the number.
    - f. To square a number ending in 5, drop the 5, multiplying the remaining number by one more than itself, then annex 25.
6. Types of business arithmetic problems to use.
    - a. Verifying extensions.
    - b. Computing payrolls.
    - c. Billing.
7. Decimals in multiplication.
    - a. When decimals are multiplied, point off in the product, beginning at the right, as many places as there are decimal places in the two numbers that are

being multiplied.

DIVISION

Division is the arithmetical process of determining how many times one number is contained in another. It is the reverse of multiplication. The result obtained by dividing one number by another is called the quotient. The number divided is called the dividend and the number by which the dividend is divided is called the divisor. If the divisor is not contained the exact number of times in the quotient the result is the remainder.

1. Introduction.
    - a. Only by a complete mastery of the fundamentals can satisfactory work be done in arithmetic and other subjects that require practical use of arithmetic.
2. Skill development.
    - a. Always divide the complete divisor into the first figure of the dividend.
    - b. The remainder must always be smaller than the divisor.
    - c. The last number of the quotient must always be directly above the last number of the dividend.
    - d. Watch the placement of the numbers in the quotient.
    - e. Estimate the answer.
    - f. Fractional results are commonly avoided. Carry the quotient from two to four decimal places.
    - g. Long division should never be used when the divisor

is twelve or less.

   h. Before dividing decimals, move the decimal in the divisor to the right to make a whole number, then move the decimal point in the dividend the same number of places to the right.

3. Checking division.
   - a. Multiply the quotient by the divisor, and add the remainder, if any, to the result. The result should be the same as the dividend.
   - b. Casting out nines.
4. Short methods.
   - a. To divide an integer by 10, 100, 1000, etc., point off as many places in the integer as there are zeros in the divisor.
   - b. To divide a decimal by 10, 100, 1000, etc., move the decimal point in the decimal as many places as there are zeros in the divisor.
5. Types of business arithmetic problems to use.
   - a. Averages.
     - (1) To find the average of two or more numbers, divide the sum of the numbers by the number of numbers.
   - b. Short division problems for rapid calculation and speed development.

DECIMAL FRACTIONS

Decimal fractions or decimals are numbers written after a

decimal point without a denominator. Decimals are so called because their denominators are ten or a multiple of ten. When the decimal is read, the denominator is named and is indicated by the number of figures used to write the decimal fraction.

1. Skill development.
    a. To change a common fraction to a decimal, annex ciphers to the numerator and divide by the denominator.
    b. To extend a complex decimal add ciphers to the numerator of the fraction and divide by the denominator.
    c. To add whole numbers and simple decimals place the numbers in columns so that the decimal points are directly under each other, and add the usual way.
    d. To add whole numbers and complex decimals, extend the complex decimals until the fractions are removed or the decimals are extended the same number of places; and then add the usual way.
    e. To subtract simple decimals, place the decimal points directly under each other and subtract as in the subtraction of mixed numbers.
    f. To subtract a simple decimal and a complex decimal, extend the shorter complex decimal until the fraction is removed or until there are as many places to the right of the decimal point in the minuend as there are places to the right of the decimal point in the subtrahend, and then subtract in the usual way.
    g. To multiply one simple decimal by another simple decimal,

multiply in the usual way and point off as many places in the product as there are places pointed off in both the multiplicand and the multiplier.

h. To multiply complex decimals change the fraction to a decimal if it can be done or change the complex decimals to improper fractions as mixed numbers are changed.

i. To divide one simple decimal by another, divide the usual way, and point off as many places in the quotient as those in the dividend exceed those in the divisor.

j. To divide one complex decimal by another, change the complex decimals to simple decimals if possible and then divide; otherwise multiply both numbers by the lowest common multiple of the denominators of the common fractions before dividing.

k. Teaching emphasis.

   (1) Stress importance of decimal fractions in the arithmetical computations used in business transactions.

   (2) Exceptional care must be taken in determining the position of the decimal point in writing decimal fractions and in solving decimal problems.

   (3) Decimal fractions predominate in business. Show that both decimal and common fraction forms are different expressions of the same value.

   (4) Refer to newspaper references, baseball scores, meters, distances between places, and money.

l. Types of business arithmetic problems to use.

(1) Hourly pay rate problems.

(2) Statistics breakdowns.

(3) Cost and selling price.

(4) Budgeting.

(5) Payrolls.

COMMON FRACTIONS

When anything is divided or broken into equal parts, one or more of the parts is a fraction of the whole thing. If we wish to indicate that a quantity less than a unit is to be taken, we must make use of a symbol called a fraction. A fraction expresses one or more of the equal parts into which a unit is divided.

A fraction is composed of a numerator, which is written above and a denominator, which is written below, a horizontal line.

1. Definition of terms.
    a. Common fractions are classified as simple, compound, and complex; proper and improper; and as parts of mixed numbers.
    b. A simple fraction is one whose numerator and denominator are whole numbers.
    c. A compound fraction is a fraction of a fraction.
    d. A complex fraction is one in which either or both the numerator or the denominator are not whole numbers.
    e. A proper fraction is one in which the numerator is less than the denominator.

   - f. An improper fraction is one in which the numerator equals or exceeds the denominator.
   - g. A mixed number is a whole number and a fraction taken together.

2. Fundamental principles.
   - a. To change an improper fraction to a whole or a mixed number, divide the numerator by the denominator.
   - b. To change a mixed number to an improper fraction, multiply the whole number by the denominator, add the numerator to the product, and place the result over the denominator.
   - c. To reduce a fraction to its lowest terms, divide both the numerator and the denominator by any common divisor and continue to divide until no common divisor greater than one can be found.
   - d. To change a fraction to higher terms, multiply both numerator and denominator by the same number.
   - e. To change a compound fraction to a simple fraction, place the product of the numerators over the product of the denominators.
   - f. To change a complex fraction to a simple fraction, divide the numerator by the denominator.
3. Addition of fractions and mixed numbers.
   - a. When two fractions have the same denominator, they are added by adding the numerators.

   - b. When the fractions to be added have a different denominator, find the least common multiple of their denominators.
   - c. To find the sum of mixed numbers, add the fractions first and then add the sum of the fractions to the whole number.

4. Subtraction of fractions and mixed numbers.
   - a. When two fractions have the same denominator, they are subtracted by subtracting the numerators.
   - b. When the fractions to be subtracted have different denominators, find the least common multiple of their denominators.
   - c. To subtract mixed numbers, find the difference between the whole numbers.
5. Multiplication of fractions and mixed numbers.
   - a. To multiply one common fraction by another common fraction, place the product of the numerators over the product of the denominators.
   - b. To multiply a common fraction by a whole number, express the whole number as a fraction and then place the product of the numerators over the product of the denominators.
   - c. To multiply one mixed number by another mixed number, change the mixed numbers to improper fractions and multiply the usual way.
   - d. To multiply a mixed number and a common fraction,

change the mixed number to an improper fraction and multiply the usual way.

6. Division of fractions and mixed numbers.
    - a. To divide a common fraction by a whole number, divide its numerator or multiply its denominator by that number.
    - b. To divide a whole number by a fraction, divide the whole number by the numerator and multiply by the denominator; or invert the fraction, multiply the whole number by the numerator, and divide the product by the denominator.
    - c. To divide one common fraction by another, invert the divisor and multiply.
    - d. To divide one mixed number by another, change the mixed numbers to improper fractions, invert the divisor and multiply.
    - e. To divide a mixed number by a whole number, change the mixed number to an improper fraction and divide the numerator or multiply the denominator by the whole number.
    - f. To divide a whole number by a mixed number, change the mixed number to an improper fraction, invert, and multiply.
7. Teaching emphasis.
    - a. Stress importance of common fractions in the arithmetical computations used in business transactions.

   - b. Write fractions carefully and neatly.
   - c. All fractions must be reduced to their common denominator before they can be added or subtracted.
   - d. Show the dependency of the arithmetic of business on fractions and decimals. Ex., the grocer who sells merchandise by the pound, dozen, quart, bushel, or fractional parts of those units.

8. Short methods.
   - a. Cancellation.
   - b. The four step process.
9. Types of business arithmetic problems to use.
   - a. Billing.
   - b. Preparation of inventories.
   - c. Business reports.
   - d. Division of profits.

ALIQUOT PARTS

For anyone engaged in work that requires rapid calculation, it is necessary to recognize immediately whether the problem contains any aliquots or multiples of aliquots. Skill in the use of aliquot parts develops speed in calculating many kinds of problems.

An aliquot part of a number is a part that will be contained in that number without leaving a remainder. A multiple of an aliquot part is any number of times the aliquot part.

1. Skill development.
   - a. Make a chart of the most common aliquot parts and

show their relationship as decimals and common fractions.

- b. Memorize the most common aliquot parts.
- c. Use aliquot parts in finding the cost of commodities sold by the pound, yard, gallon, bushel, and like measurements.
- d. Use aliquot parts in figuring bills, inventories, and discounts.
- e. Use aliquot parts in finding the cost of commodities sold by the hundred (C), by the thousand (M), and by the ton.
- f. Either the quantity or the price can be used as an aliquot part.
- g. Division can be simplified by the use of aliquot parts.

2. Application of aliquot parts.
    - a. When solving a problem involving a number that is an aliquot part of 100 or $1, multiply or divide by the fractional equivalent rather than by the whole number.
    - b. To find the quantity when the cost and price are given, divide the cost by the price.
    - c. To find the price when the cost and quantity are given, divide the cost by the quantity.
3. Teaching emphasis.
    - a. The aliquot parts of 100, such as halves, thirds,

fourths, fifths, sixths, eighths, twelfths, and sixteenths are the most commonly used in business. Sevenths and ninths are also used to some extent.

   b. Much of the subsequent work in percentage, discount, and interest makes use of aliquot parts.
   c. Use of aliquot parts is a time-saving factor.

4. Types of business arithmetic problems to use.
   a. Billing.
   b. Inventory taking.
   c. Interest.
   d. Discount.
   e. Cost prices.
   f. Selling prices.
   g. Percentage.

PERCENTAGE

Percentage is an application of the principles of common and decimal fractions to the solution of business problems. It is a method of expressing relationships by hundredths or per cents. There is no principle of arithmetic found in percentage that is not, or may not, be found in fraction problems.

Percentage is used in making calculations pertaining to interest, discount, taxes, and commissions. Moreover, our money system is based on the dollar, 100 cents, and frequently fractions of a dollar are expressed in per cent forms.

1. Percentage terminology.
   a. Per cent is another name for hundredths.

- b. % is the symbol for per cent.
- c. Base. The base is the number on which the per cent is computed.
- d. Rate. The rate is the per cent to be taken.
- e. Percentage. The percentage is the result obtained by taking as many hundredths of the base as the rate shows.
- f. Amount. The amount is the sum of the base and the percentage.
- g. Difference. The difference is the percentage subtracted from the base.

2. Skill development.
    - a. In changing decimals to per cents, move the decimal point two places to the right and affix the % sign.
    - b. In changing per cents to decimals, remove the % sign and move the decimal point two places to the left.
    - c. In changing decimals to fractions, express the decimal as a fraction with the denominator 100 and reduce to lowest terms.
    - d. In changing fractions to decimals, divide the numerator by the denominator.
    - e. Drill in the use of the following percentage formulas.
        - (1) Base times Rate equals Percentage.
        - (2) Percentage divided by Rate equals Base.
        - (3) Percentage divided by Base equals Rate.

(4) Base plus Percentage equals Amount.

(5) Base minus Percentage equals Difference.

(6) Amount divided by 100% plus Rate equals Base.

(7) Difference divided by 100% minus Rate equals Base.

3. Types of percentage problems.

a. To find a certain per cent of a number.

(1) Given the base and the rate, the percentage is found by multiplying the base times the rate.

b. To find what per cent one number is of another.

(1) Given the percentage and the base, the rate is found by dividing the percentage by the base.

c. To find the number of which a given number is a certain per cent.

(1) Given the percentage and the rate, the base is found by dividing the percentage by the rate.

4. Teaching emphasis.

a. Dividing the product of two factors by either of those factors will give the other factor.

(1) If 3 times 2 equals 6, then 3 equals 6 divided by 2.

(2) If R times B equals P, then B equals P divided by R and R equals P divided by P.

(3) 12% of $350 equals ? (B times R equals P)
12% of ? equals $42 (P divided by R equals B)
? of $350 equals $42 (P divided by B equals R)

b. Get pupils to recognize type form to which any

problem belongs.

  c. Emphasize finding 1% of a number. Point off two places in the number and find the fractional part of the result.
  d. Explain meaning of "increase", "decrease", "more than", "less than", and "as much as".

5. Types of business arithmetic problems to use.
  a. Commission.
  b. Interest.
  c. Discount.
  d. Markup.
  e. Markdown.
  f. Sales.
  g. Costs.
  h. Comparisons.
  i. Averages.

PRACTICAL MEASUREMENTS AND DENOMINATE NUMBERS

Business transactions often involve the use of practical measurements. To make computations involved in measurements accurately and quickly, it is necessary to have a knowledge of common measurement tables.

Only denominate numbers that are commonly used should be taught in a business arithmetic course.

1. Skill development.
  a. Acquaint students with measurements and show how they should be used.
  b. Acquaint pupils with measurement terminology.
  c. Explain the following terms: angle, right angle, quadrilateral, parallelogram, rectangle, square, diagonal, base, altitude, area, perimeter, triangle,

right-angled triangle, acute triangle, scalene triangle, obtuse triangle, and hypotenuse.

- d. Pupils should have an understanding of the following types of measurement and the ability to make proper computations:
    - (1) Linear measure--to measure lines and distances.
    - (2) Square measure--to measure surfaces and areas.
        - (a) Perimeter--the distance around a plane surface.
        - (b) Area--the number of square units within the perimeter of a plane surface.
        - (c) Area of a triangle.
        - (d) Area of a circle.
    - (3) Cubic measure--to measure the volume and capacity.
    - (4) Miscellaneous measures--liquid, dry, weights, time, paper, lumber, money, and metric.
- e. Provide drill in adding, subtracting, multiplying, and dividing denominate numbers.
- f. Teach square root.
    - (1) The square root of a number is one of two equal factors which produce that number.

2. Teaching emphasis.
    - a. Emphasize practical measurements and denominate numbers as they are used in business transactions and the personal life of pupils.
3. Types of business arithmetic problems to use.

   a. Painting, carpeting, masonry; capacity of bins, tanks, cisterns, and reservoirs; land surveys, specific gravity, plastering, paving, papering, lumber, plumbing, shingling, and measurements of wood.

INTEREST

Interest is the cost charged for using someone's money for a specified length of time. Most states have laws limiting the rate of interest charged on loans which is known as usury and involves a penalty on the lender.

1. Interest terminology.
   a. Principal--the sum of money borrowed.
   b. Interest---the sum of money paid for the use of the principal.
   c. Amount-----the principal plus the interest.
   d. Rate-------the fractional part of $1, paid for the use of $1, for one year. The rate is usually expressed as a per cent or as a decimal.
   e. Time-------the number of days, months, or years money is borrowed.
2. Types of interest calculations.
   a. Simple interest--interest calculated on the principal sum on a time basis of 360 days per year; also known as ordinary interest and bankers interest.
   b. Accurate interest--interest calculated on the principal sum on a time basis of 365 days per year.

(1) Also known as exact interest used by the United States Government.

(2) To change simple interest to accurate interest, add 1/73 of the simple interest to the simple interest.

(3) To change accurate interest to simple interest, deduct 1/73 of the accurate interest from the accurate interest.

c. Compound Interest--simple interest calculated on the principal sum plus the unpaid interest earned during a previous period. This method is used by savings banks and life insurance companies.

3. Cancellation method of finding interest.

a. Using the formula P times R times T equals I.

(1) P times R times T equals I.

(2) R equals I divided by P times T.

(3) P equals I divided by R times T.

(4) T equals I divided by P times R.

b. When time is less than one year, it must be expressed as the number of days over 360 days.

c. Emphasize that rate is expressed as a decimal or a common fraction.

4. Bankers' 60-day method.

a. The interest charged on $1 for one year at 6% is six cents, or one cent, in 1/6 of a year. 1/6 of one year (360 days) is equal to 60 days. Therefore,

the interest charge on $1 for 60 days can be found by moving the decimal point in the principal ($1) two places to the left.

- b. To find the interest for 6 days at 6% move the decimal point in the principal three places to the left.
- c. To find the interest for 600 days at 6% move the decimal point in the principal one place to the left.
- d. To find the interest for 6000 days, no decimal point is moved since the interest matches the principal.
- e. Use aliquot parts.
  - (1) When interest rate is 1 1/2% divide 6% I by 4.
  - (2) When interest rate is 2% divide 6% I by 3.
  - (3) When interest rate is 3% divide 6% I by 2.
  - (4) When I rate is 4% deduct 1/3 of 6% interest.
  - (5) When I rate is 4 1/2% deduct 1/4 of 6% interest.
  - (6) When I rate is 5% deduct 1/6 of 6% interest.

5. Computing the time for a loan.
   - a. Compound time method.
     - (1) Before the interest can be determined on any amount, it is necessary to find the number of days between the dates.
     - (2) Subtract the year, month, and day that the period ends.
     - (3) Every year is considered as having 360 days and every month 30 days.
     - (4) Always use compound time if the method to be

used is not indicated. This is the most commonly used method in business.

b. Exact time method.

   (1) Count the actual number of days between any two dates, excluding the first date and including the last date.

   (2) Exact time is always used in finding the interest on U. S. Government securities and in computing interest on bonds.

c. Banker's time method.

   (1) Determine first, the exact number of years and months, each year being considered as having 360 days and each month, 30 days. Then determine the exact number of days for any remaining part of a month.

d. The accurate interest method.

   (1) This method is used by the U. S. Government in computing interest on its securities. Interest tables make the computation of interest by this method easy.

   (2) Find the time by the exact method.

   (3) Find the interest by the cancellation method.

   (4) Use the 365-day year as a basis.

e. Compound interest method.

   (1) When interest is figured annually, find the simple interest for one year at the given rate

on the principal. (The interest is not computed on amounts less than $1). Add the interest to the principal to arrive at the amount that is to be used as the principal at the beginning of the second year.

(2) When the interest is figured for more than one year, find the simple interest for one year on the new principal. The sum of this interest plus the principal used to find this interest will be the principal to be used the third year. Repeat this procedure as many times as the number of years during which the compound interest is to be computed.

(3) When interest is compounded semi-annually, quarterly, and monthly, compute the interest twice a year, four times a year, or twelve times a year as the case may be.

(4) Make use of compound interest tables.

SINKING FUNDS

In financing large undertakings, immediate funds are provided by borrowing the money and issuing bonds. The bonds are payable over a period of years. Interest on the bonds is payable during the life time of the bonds. To provide for paying the bonds at maturity, each year or semi-annually a sufficient sum of money is set aside which with compound interest, will amount to the face value of the bonds. The sum set aside is

called a sinking fund.

1. Use a sinking fund table.
    - a. Find the number of years or periods for which the sinking fund is to be created.
    - b. Find the sum to which $1 yearly will accumulate.
    - c. Multiply the amount of $1 by the periodic payment to find the amount accumulated in the sinking fund.
2. Principal, Rate and Yield.
    - a. To find the principal necessary to produce a given yield.
        - (1) Find the interest charge on $1 for the time and the interest rate given.
        - (2) Divide the yield on $1 into the total yield desired to find the principal.
        - (3) Yield divided by Rate divided by Time over 360 equals Principal.
    - b. Find the time necessary to produce a given yield when the principal and the interest rate are given.
        - (1) Find the interest charge for 1 year on the principal at the rate given.
        - (2) Yield desired divided by the interest for 1 year times 360 days equals the time required.
    - c. Find the rate necessary to produce a given yield when the principal, interest, and time are given.
        - (1) Find the interest on the principal for the given time.

(2) Divide the interest at 1% into the given interest to find the rate.

(3) Interest divided by the principal divided by time over 360 equals the rate.

3. Teaching emphasis.
   a. Interest is percentage with time introduced as an added factor.
   b. Stress ease, speed, and accuracy features of the 60-day interest method.
   c. Use cancellation method when computing interest by the accurate-interest method.
   d. Compound interest is interest computed on interest.
4. Types of business arithmetic problems to use.
   a. Simple interest.
   b. Exact interest.
   c. Compound interest.
   d. Bonds.
   e. Sinking funds.
   f. Investments.

DISCOUNT

To encourage quantity buying and early payments it is common to offer discounts to the purchaser. The seller gains by the decrease in handling costs and by obtaining cash quickly which in turn reduces collection costs and losses due to bad debts.

Bankers collect interest in advance when loans are made on negotiable instruments. This procedure is known as bank discount.

1. Types of discount.

a. Quantity discounts.
   (1) A discount allowed a purchaser because he buys more than the minimum quantity of a given article at one time.
   (2) The discount rate is offered according to the quantity of a purchase.

b. Cash discount.
   (1) A discount allowed for the early payment of a bill of goods.
   (2) Cash less 2%--two per cent of the bill will be deducted when the payment is made on time.
   (3) 3/10, n/30--three per cent of the bill will be deducted if payment is made before 10 days, otherwise the net amount is due and payment of the bill must be made on the thirtieth day.
   (4) 2/10, 1/30, n/60--two per cent of the bill will be deducted if payment is made within 10 days, one per cent will be deducted if payment is made within 30 days, and the entire amount is due after 30 days pass by.
   (5) Multiply the amount of the bill by the rate of discount and subtract the discount from the amount of the bill to obtain the net price.

c. Anticipation discount.
   (1) A discount based on the amount of invoice less the cash discount.

(2) An allowance made for payment before the due date of an invoice at a specified rate based on the number of days between payment date and due date.

d. Trade discount.

(1) A reduction offered to dealers on the list price of articles. Manufacturers and jobbers send out written lists quoting their discounts. These lists are called discount sheets.

(2) The net price is the price resulting after all trade discounts have been deducted from the list price.

(3) Two or more discounts allowed on a given list price are known as a discount series.

(4) Discount series are computed by subtracting each discount in the series from the cost remaining after the preceding discount has been deducted. Changing the order of discounts does not change the final result.

(5) To find a single discount equal to a series of discounts, add the two discounts and from their sum subtract one, one-hundredth of their product.

(6) When there are three or more discounts, take the result of the first two with the third, and continue in like manner with the fourth.

(7) Tables can be used to find the net price of an article subject to a series of discounts.

(8) To calculate the list price when the net cost price and trade discounts are given, find the single discount equivalent if a series of trade discounts is given. That which is unknown and which is to be found is always represented by 100%. Subtract the single trade-discount equivalent from the list price of 100% to find the per cent that the net price is of the list price. Find 1% and multiply this result by 100 to get 100% or the list price.

(9) To calculate the list price and the net price when the trade discounts and the amount of discount are given, find the single discount equivalent if a series of trade discounts is given. Find 1% by dividing the single discount equivalent into the amount of the discount. Multiply 1% by 100 to find the list price. Subtract the amount of trade discount from the list price to find the net price.

e. Bank discount.

(1) Bank discount is simple interest collected in advance by a bank or a banker who accepts negotiable paper from its owner for discount before maturity.

(2) Discount is the bankers' charge for advancing payment on the paper.

(3) Due date, or date of maturity, is the date on which the paper becomes due and payable.

(4) Discount period is the time between the date of discount and date of maturity.

(5) To find the date of maturity and term of discount, where time is given in days, count ahead from the date of the paper the number of days given. Where the time is given in years, or months, count ahead from the paper the number of years or months given. The difference in time between the date of discount and the date of maturity is the term of discount.

(6) To find the proceeds of an interest-bearing note, find the date of maturity. Find the interest at the given rate for the full time. Add the interest and the face of the note to find the amount. Find the discount, at the given rate of discount, on the amount for the term of discount. Subtract the discount from the amount to find the proceeds.

(7) To find the proceeds of a non-interest-bearing note, find the date of maturity. Find the term of discount. Find the bank discount by figuring the interest on the face of the note for the term of discount at the discount rate. Subtract the bank discount from the value of the note at

maturity, the remainder being the proceeds of the note.

2. Teaching emphasis.
   a. Trade discounts and cash discounts are simple applications of principles studied in percentage.
   b. Encourage use of aliquot parts in the solution of trade and cash discount problems.
   c. Encourage students to solve trade and cash discount problems, orally.
   d. Emphasize the importance of accuracy in finding the date of maturity and the term of discount of a note.
   e. The exact number of days from the date of discount to the date of maturity is the term of discount.
   f. On interest-bearing notes add the interest to the principal before determining the bank discount and collection charge.
   g. The collection fee is computed on the amount of money to be collected or on the amount of the note or draft.
   h. Explain the different purposes and forms of notes to the class.
   i. Explain: note, draft, acceptance, indorsement, after sight, after date, trade acceptance, payee, drawer, drawee, maker, indorser, and protest.
3. Types of business arithmetic problems to use.
   a. Loans, credit sales, mortgages, notes, and drafts.

GRAPHS

Graphs are used to present statistical data in a form which makes it possible to interpret more readily certain facts contained in the data, and to draw conclusions in a comparative way from the facts as presented. These graphically shown relationships are extremely helpful and valuable to merchants, business executives, government officials, and to laymen in studying statistical data. A graph represents pictorially the relation between two units of measure.

1. Types of graphs.
    a. Bar graphs--used to compare directly the relationship existing among several quantities or values. Bar graphs may be either vertical or horizontal.
        (1) Assemble the data to be shown. Use graph paper if possible. Choose a scale that will make the interpretation of the graph easy. Put the figures on the graph and draw the bars to the scale chosen. Place time relationships along the horizontal scale for uniformity.
    b. Single-line graph and a rectangle graph----used to show relationships of several items that go to make up a whole quantity and of several values that make up a total sum of each other and to the total sum.
        (1) Use a single vertical line or any length or a rectangle as the base of line graph. Determine the number of items or values and the total sum

to which these items are equal. Indicate the relationships among the items or values on the graph line or rectangle by the distance between each.

c. Curved or broken-line graphs. Used to show the connection between several figures that have a definite relationship to one another and to the whole and to show the changes in quantities at certain times or during a definite period of time.

   (1) Use graph paper if possible. Use a horizontal scale for the time intervals and a vertical scale for the quantity or the value of the units. Locate the place dots on the graphs to indicate the intersecting point of time and quantity relationship. Connect the dots by straight or curved lines. Indicate title of graph and quantity or value measured by it.

d. Circle graphs. Used to show relationship between quantities or values measured by it.

   (1) Use a circle diagram, drawing the graph with the aid of a protractor. When a relationship on a percentage basis (100%) is to be shown, the percentage is represented by a 360 degree circle. Each percentage must be changed to its degree equivalent.

2. Teaching emphasis.

- a. A graph is a presentation of facts and figures in the form of charts or pictures.
- b. Simplicity of form in which the graph is drawn determines its value.
- c. Reliability and validity is determinea by the accuracy of the facts and figures and care used to transfer them to the graph.
- d. Use graph paper.
- e. Show the practicability and value of graphs and their wide use in business, government, and everyday life.

3. Types of business arithmetic problems to use.
    - a. Depreciation charts, profit distribution, budgets, periodic sales summaries, and government expenses.

PROBLEM-SOLVING IN BUSINESS ARITHMETIC

A problem is a statement representing a situation that requires some conscious effort for adjustment. If the solution is made in terms of number, the problem resolves itself into an arithmetic problem.

Because of their disciplinary nature, large numbers and puzzling problems were considered of paramount importance. The present view holds that attainment of social insight, use of practical numbers, proper language interpretation, use of arithmetical skills, and training in the development of thinking power are of utmost importance.

A good problem should appeal to the students' interests, should be within the sphere of their experiences, and must be

true to life. The problem should be concrete or within the experience of the students.

The terminology of the problem must be within the comprehension of the students and new terms must be explained. Most of the difficulties met by students in solving problems are those in understanding the terminology in which the problems were phrased. Problem material should be drawn from life situations.

There are three types of problems. The isolated problem applies the arithmetic process taught but usually does not contain familiar situations. The narrative problem relates to social, civic, or business activities and is usually made up of several related problems whose results are connected. The real situation problem contains matters of student interest and requires a general exercise of judgment.

All problems may be reduced to one or more of three forms consisting of finding a part of a number, finding what part one number is of another, and finding the whole number when a part is given.

Accuracy in problem solving can be developed by increasing power in performing fundamental operations, developing ability in approximating answers with a fair degree of skill, developing skill in testing the soundness of reasoning, increasing the ability to use a variety of solutions, and by the use of methods to check results.

Speed in problem solving can be attained by avoiding

unnecessary figures and labels, by using short cuts as much as possible, and omitting formal analysis.

When solving problems the following outline will prove helpful:

1. Determine the facts.
    a. Determine the known facts or values stated in the problem.
    b. Determine the unknown fact or facts that are to be found.
    c. Do not consider facts which are unnecessary to solve problems.
2. Select the correct mathematical operations.
    a. Determine how the known facts may be treated or combined to find the unknown fact or facts.
    b. Pick out the things to do and the order to do them.
    c. Do not add when you should multiply, etc.
    d. Make certain the given facts are expressed in proper units. Ex., multiply inches by inches to get square inches.
3. Estimate results.
    a. Make a rough estimate of the answer before solving for the exact result.
4. Check every step leading to the solution.
    a. Verify the accuracy of all calculations.
    b. Make certain the result is the desired solution.

SUMMARY

Students beginning a business arithmetic course have not been taught any arithmetic based on business in their previous school training. Therefore, this functional course is organized on the premise that beginning business arithmetic students need the information presented in this course. The results of the achievement tests administered by the writer before writing this study provide factual evidence of the need for the instruction proposed.

It is expected that the material offered in the functional course can be covered in one school semester of 18 weeks in a business arithmetic course. The students should acquire a working knowledge of arithmetic fundamentals taught with emphasis on their relationship with computations used in business transactions.

After the completion of this course, the students should be ready to concentrate on actual business arithmetic problems. Therefore, it is proposed that the remaining 18 weeks of the second semester be devoted to solving upgraded business arithmetic problems, with continued emphasis on fundamental operations through the medium of constant reviews.

The need for administering prognostic, inventory, and achievement tests in business arithmetic should never be neglected. Tests are excellent mediums in revealing pupil weaknesses in the subject, provide a basis for redirecting teaching efforts, and reveal where remedial work is necessary.

CHAPTER VI

A SUMMARY OF THE STUDY

It is interesting, stimulating, and challenging to read educational literature especially when the phase discussed pertains to a teachers' specialization of study. Moreover, after an absence of four years from the field a teacher becomes amazed at the divergence of opinion on the part of educational leaders as to the value of offering certain subjects to pupils attending school.

The writer's specialization is in business education and his interest is centered on the teaching of business arithmetic. One of his first moves to reorient himself was to find out what had happened in his educational field. This was done by reading a considerable number of periodicals, books, and studies pertaining to business education and especially business arithmetic courses.

It was disappointing to discover that there were a few business education specialists who wanted to have business arithmetic taken entirely out of the business course because the pupils were not learning anything that would be of future value to them. Then there were several other authorities who believed that business arithmetic should be correlated with and taught as part of the junior business training course or as part of the bookkeeping course. However, there were a

great many authorities who strongly felt that business arithmetic was of great value and should be taught as a separate course under the responsibility of the business department. Another point of view was that the business arithmetic course as taught by business teachers was unsuccessful and should be transferred to the mathematics departments of the high schools.

Nevertheless, in spite of the varied opinions, the majority of business education authorities felt that the knowledge of business arithmetic was essential as a preparatory and basic course for pupils taking a business course. It was further recommended that the subject not only should be offered for business pupils for its vocational value but it also should be offered to all pupils attending secondary schools for its personal value. It is difficult to question the fact that a knowledge of business arithmetic is essential to the future citizen when he has to figure out his income taxes, make up a budget, finance the buying of household appliances, purchase homes or automobiles, carry on bank transactions, calculate travel cost comparisons, and plan his savings, investments, and insurance.

Starting on the premise that a knowledge of business arithmetic is essential to everyone, the writer decided to experiment with his pupils to find out how much they knew about the subject. The objective was to attempt to discover common and fundamental arithmetical weaknesses on the part of the pupils and afterwards to organize a course of study to overcome those

deficiencies.

The first phase of the experiment was to find out if there was a need for offering a business arithmetic course in the high school. If the pupils could show a high arithmetical ability, then it would be safe to eliminate the course and offer some other subject instead which would be of greater value. A standardized achievement test was selected and administered to 72 freshman pupils taking a business arithmetic course and the same test was given to a small group of pupils taking a senior bookkeeping course. As a result it was found that the freshmen attained a mean arithmetical achievement of 58 points which represents a grade equivalent of seven years and eight months and an arithmetical age equivalent of thirteen years and four months. The mean chronological age of the group tested was fourteen years and five months. The deficiency of one year and one month in the arithmetical age of this group proves that a business arithmetic course is necessary in the secondary schools especially for business pupils.

The next step was to find out if a twelfth-year group of business pupils had any greater arithmetical ability than the ninth-grade group. A small group of senior business pupils was selected for this part of the experiment and the result is offered merely as an indication. The twelfth-grade group attained a mean arithmetic average of 61 points which represents a grade equivalent of eight years and one month and an arithmetical age equivalent of thirteen years and seven months.

The average chronological age of this group is seventeen years and they should have obtained an almost perfect score on the test. Even though this class had three years of bookkeeping study they achieved a score three points greater than that of the freshman group. It is logical, therefore, to assume that pupils pursuing a course in bookkeeping do not lose any arithmetic knowledge and gain only a slight degree of arithmetic ability. Nevertheless, this group revealed a need for specialized study in business arithmetic more so because of their vocational specialization.

The next measure available was the opportunity to compare the scores of some of the ninth-grade group who had taken the same test the latter part of their eighth-grade year. The results of this comparison were amazing since it was discovered that out of the twenty-five tests compared no pupil showed a decrease of arithmetical ability, four showed no change in arithmetical age and the remaining twenty-one showed increases in arithmetical age ranging from one month to one year and three months, with an average increase of six months for the entire group. The results indicate markedly that there was no loss of arithmetical ability and that pupils taking a business arithmetic course definitely acquire additional and substantial arithmetic ability.

After the tests were administered and the results studied, the next phase of the study was to discover the arithmetic weaknesses of the pupils tested. Each problem in the arithmetic

achievement test was analyzed and the arithmetic fundamentals, or combination of fundamental requirements, were determined. A tabulation of the problems was made and the number of problems answered correctly, the number of problems answered incorrectly, and the number of problems omitted were counted.

On the basis of the tabulated problems pupils showed a need for additional concentrated study in the fundamental processes of arithmetic and a decided need of practice and study in arithmetic problems involving the computation of combined fundamental arithmetic processes. The proposed functional course of study in business arithmetic was then organized to fulfill the needs of the pupils discovered as a result of the administration and study of the standardized arithmetic test.

On the basis of this study, it is strongly urged that serious thought be given to the proposal of reorganizing the offering of business arithmetic courses as part of the business courses. The recommendation is made that a two-year course of business arithmetic be set up. The first year course should be organized on a consumer use basis with emphasis placed on business arithmetic knowledge needed by the consumer. The first year course should be required of all business pupils and should be an elective for the other high school ninth and tenth-graders. In the twelfth year a full year of business mathematics should be offered and required of all pupils specializing in bookkeeping and clerical practice. Retail selling and stenographic pupils should be given a half-year course of review

business arithmetic in their twelfth school year.

Such a revision will increase the arithmetical ability of our business pupils, prepare them for collegiate accounting courses, and give them the knowledge necessary to compute whatever calculations are required of them when they obtain their future positions in business.

If it is thought necessary to expose college preparatory students to four years of mathematics in a high school, there should be no objection to exposing business pupils to at least two years of study of a subject that is of great value to them.

Business arithmetic is a subject that is important enough to have every pupil in the ninth grade study. The personal use value of the subject in itself justifies this recommended requirement. Arithmetic knowledge obtained in the elementary grades is insufficient when pupils have to make simple computations in matters that effect their personal life.

Our rapidly expanding economic life increases the need for making arithmetical computations in business matters. It is quite common for most people to have checking accounts. There has been an enormous expansion in installment sales with the result that almost every person at some time or other buys a house, automobile, furniture, household appliances and many other commodities on the installment plan. Loan organizations make money available to the potential borrowers. The majority of our citizens do not have the arithmetical know-how in order to become intelligent consumers of financial facilities and

transactions available to them in modern business. The fact cannot be disputed that a knowledge of how to efficiently use business facilities plus the ability to make accurate calculations when using the facilities will make business relations less complex for our future citizens. Moreover, the ability to make accurate business computations is indispensable for the person who intends to take up a business career.

The fact that there is a considerable amount of disagreement as to the value of teaching business arithmetic shows that particular attention should be given to the teaching of the subject by business teachers. It is easy to pass the blame onto the elementary grades where pupils are supposed to master the elementary fundamentals of arithmetic or to push the subject onto the mathematics departments in high schools but the fact still remains that the subject is being taught mostly by business teachers and they are the people who must turn out pupils with sound arithmetical knowledges that will be of great help to them especially in their future positions in business.

BIBLIOGRAPHY

Allen, Richard D. and others. Metropolitan Achievement Tests, Advanced Arithmetic Test: Form A. New York, World Book Company, c1933. 7 p.

----------------------------. Metropolitan Achievement Tests, Supervisors Manual; Rev. Ed. New York, World Book Company, c1941. 76 p.

Altholz, Nathaniel. "Commercial Arithmetic." Modern Methods of Teaching Business Subjects, Fourth Yearbook. Philadelphia, Eastern Commercial Teachers Association, 1931. p. 83-85.

Atticks, Kelsey C. "Suggestions for Improving Teaching Techniques for the Development of Skills in the Introduction to Business Arithmetic." Modernizing Business Education, Eleventh Yearbook. Philadelphia, Eastern Commercial Teachers Association, 1938. p. 199-206.

Billig, Albert L. "Student Attitude as a Factor in Mastery of Commercial Arithmetic." The Mathematics Teacher 37:170-73, April 1944.

----------------. "Approaches in Learning." School and Society 59:285-87, April 22, 1944.

Bird, Ethel M. Teaching the Use of Aliquot Parts." Modern Methods of Teaching Business Subjects, Fifth Yearbook; Vol. II. Philadelphia, Eastern Commercial Teachers Association, 1932. p. 314-16.

Blackstone, E. G. "Commercial Education on the Secondary Level." Encyclopedia of Educational Research. New York, The Macmillan Company, 1941. p. 326-40.

Cassidy, Walter L. "The Commercial Mathematics Curriculum." School Science and Mathematics 41:571-78, June 1941.

Cowan, Harold E. "Basic Problems in Business Arithmetic." Business Education for Tomorrow, Fourteenth Yearbook. Philadelphia, Eastern Commercial Teachers Association, 1943. Chapter XX.

Curry, Preston E. and Rice, Ralph R. Business Arithmetic. Cincinnati, South-Western Publishing Company, c1933. 312 p.

Curry, Preston E. and Rice, Ralph R. Applied Business Arithmetic. Cincinnati, South-Western Publishing Company, c1940. 576 p.

Edgerton, Edward I. and Bartholemew, Wallace C. Business Mathematics. New York, Ronald Press Company, c1921. 305 p.

File, Clinton M. "The Improvement of Business Mathematics." Journal of Business Education 20:19-20, April 1945.

Frellick, Ralph S. "The Organization and Use of the Unit in the Arithmetic Class." Unit Planning in Business Education, Fifteenth Yearbook. Philadelphia, Eastern Commercial Teachers Association, 1942. p. 137-44.

Goldfarb, George. "Business Information and Arithmetic for the Consumer." Business and Business Education, Fourteenth Yearbook. New York, The Commercial Education Association of the City of New York and Vicinity, 1943-44. p. 3-8.

Good, Harry I. and Hellriegal, Leroy J. Modern Exercises in Business Arithmetic. New York, Oxford Book Company, c1938. 280 p.

------------------------------------. Today's Business Arithmetic. New York, Oxford Book Company, c1938. 280 p.

Hanna, J. Marshall. Fundamental Issues in Business Education. Monograph 48. Cincinnati, South-Western Publishing Company, 1940. 56 p.

Haynes, Benjamin R. and others. Tests and Measurements in Business Education. Cincinnati, South-Western Publishing Company, c1940. 312 p.

Haynes, Benjamin R. and Jackson, Harry P. A History of Business Education in the United States. Monograph 25. Cincinnati, South-Western Publishing Company, 1935. 159 p.

Haynes, Benjamin R. and Humphrey, Clyde W. Research Applied to Business Education. New York, The Gregg Publishing Company, c1939. 218 p.

Heiges, Myers. "A Device for Teaching the Four Fundamentals of Arithmetic." Teaching Aids and Devices and Suggested Classroom Equipment, Sixth Yearbook. Philadelphia, Eastern Commercial Teachers Association, 1933. p. 192-95.

Kanzer, Edward M. and Schaaf, William L. Essentials of Business Arithmetic. Boston, D. C. Heath and Company, c1943. 476 p.

Kiddoo, W. R. "The Use of the Slide Rule in Commercial Arithmetic." Teaching Aids and Devices and Suggested Classroom Equipment, Sixth Yearbook. Philadelphia, Eastern Commercial Teachers Association, 1933. p. 196-201.

Lennes, N. J. Senior Practical Mathematics. New York, The Macmillan Company, c1941. 584 p.

Lomax, Paul S. Commercial Teaching Problems. New York, Prentice-Hall, Inc., c1929. 200 p.

Lyon, Leverett L. Education for Business. Chicago, University of Chicago Press, c1923. 628 p.

Miner, George W. and others. Business Arithmetic. Boston, Ginn and Company, c1923. 410 p.

Nichols, F. G. Commercial Education in the High School. New York, D. Appleton Century, c1933. 514 p.

-------------. "The Case for Commercial Arithmetic." Journal of Business Education 11:4-8, December 1935.

Norris, Bessie. "Social Values that May Be Derived from Units of Instruction in Commercial Arithmetic." Business Education in a Changing Social and Economic Order, Seventh Yearbook. Philadelphia, Eastern Commercial Teachers Association, 1934. p. 146-49.

Orleans, Jacob S. and Saxe, Emanuel. "How Much Commercial Arithmetic Do Students in a Collegiate School of Business Know?" Journal of Business Education 14:14-16, 14:13-14, 14:20-22, September - November 1940.

Phillips, H. A. "Unit Organization in Business Mathematics." Business Education World 22:123-24, October 1940.

Rosenberg, R. Robert. "What to Teach in Business Arithmetic." Journal of Business Education 36:75-76, April 1936.

-------------------. "Diagnostic Tests in Business Mathematics." Business Education World 22:123-24, October 1944.

-------------------. Teaching Methods and Testing Materials in Business Mathematics. New York, The Gregg Publishing Company, c1938. 266 p.

-------------------. Essentials of Business Mathematics. New York, The Gregg Publishing Company, c1938. 326 p.

Rowan, George and Stephens, A. C. Business Mathematics Projects. New York, Prentice-Hall, Inc., c1938. 196 p.

Rubert, Victor M. Commercial and Rapid Calculation. Cincinnati, South-Western Publishing Company, c1925. Chapter III.

Shields, H. G. "Some Curriculum Techniques in the Basic Business Subjects." Improved Methods of Teaching the Business Subjects. Monograph 63. Cincinnati, South-Western Publishing Company, c1945. p. 83-85.

Speer, Charles A. "How to Develop Economic Understanding in a Commercial Arithmetic Class." Business Education in a Changing Social and Economic Order, Seventh Yearbook. Philadelphia, Eastern Commercial Teachers Association, 1934. p. 150-53.

Smith, Oliver S. Arithmetic of Business. Chicago, Lyons and Carnahan, c1921. 474 p.

Smithline, Henry M. "Relating Business Arithmetic to the Everyday Needs of the Future." Business Education for Tomorrow, Fourteenth Yearbook, Philadelphia, Eastern Commercial Teachers Association, 1941. p. 129-32.

Smithline, Henry M. and Thompson, Clyde O. Business Arithmetic. New York, Prentice-Hall, Inc., c1941. 496 p.

Strong, Earl P. The Organization, Administration, and Supervision of Business Education. New York, The Gregg Publishing Company, c1944. 356 p.

Sutton, C. W. and Lennes, N. J. Economic Mathematics. Boston, Allyn and Bacon, c1940. 584 p.

Thompson, Clyde O. "Developing a Mastery of Fundamental Processes in Arithmetic." Modern Methods of Teaching Business Subjects, Fifth Yearbook; Vol. II. Philadelphia, Eastern Commercial Teachers Association, 1932. p. 305-13.

-----------------. Thompson's Business Arithmetic. New York, Prentice-Hall, Inc., c1934. 445 p.

Thorndike, Edward Lee. The New Methods in Arithmetic. New York, Rand McNally and Company, c1921. 260 p.

Tiegs, Ernest W. and Crawford, Claude C. Statistics for Teachers. New York, Houghton Mifflin Company, c1930. 212 p.

Tonne, Herbert A. and Tonne, M. Henriette. Social Business Education. New York, The New York University Press, c1932. 288 p.

Touton, Frank C. "Business Arithmetic." Commercial Education. Boston, Ginn and Company, c1929. Chapter V.

Van Tuyl, George H. "Teaching Graphs." Modern Methods of Teaching Business Subjects, Fifth Yearbook; Vol. II. Philadelphia, Eastern Commercial Teachers Association, 1932. p. 317-23.

------------------. New Essentials of Business Arithmetic. New York, American Book Company, c1924. 302 p.

------------------. Van Tuyl's Mathematics of Business. New York, American Book Company, c1940. 502 p.

Waltham, W. Alan. "Problems of Business Arithmetic." The Contribution of Business Education to Youth Adjustment, Thirteenth Yearbook. Philadelphia, Eastern Commercial Teachers Association, 1940. p. 127-34.

Walters, R. G. The Business Curriculum. Monograph 55. Cincinnati, South-Western Publishing Company, 1942. 38 p.

APPENDIX

METROPOLITAN ACHIEVEMENT TESTS

ADVANCED ARITHMETIC TEST: FORM A

METROPOLITAN ACHIEVEMENT TESTS
ADVANCED ARITHMETIC TEST: FORM A
(*Revised*)

By RICHARD D. ALLEN, PH.D.
Assistant Superintendent of Schools,
Department of Research and Guidance, Providence

HAROLD H. BIXLER, PH.D.
Director of Research and Guidance, Public Schools, Atlanta

WILLIAM L. CONNOR, M.A.
Superintendent of Schools, Allentown, Pennsylvania

and FREDERICK B. GRAHAM, PD.M.
Assistant Superintendent of Schools, New York City

**Adv.
Arith.
A
(*Revised*)**

For Grades 7 and 8

Name.............................. Date...............19...

Grade.......Age....yrs....mos. Teacher.......................

School...............City................State...............

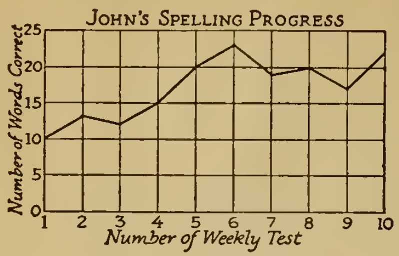
TEST	SCORE	GRADE EQUIVALENT	AGE EQUIVALENT
1. Arithmetic Fundamentals			
2. Arithmetic Problems			
Average Arithmetic			

This test is copyrighted. The reproduction of any part of it by mimeograph, hectograph, or in any other way, whether the reproductions are sold or furnished free for use, is a violation of the copyright law.

Published 1933 by World Book Company, Yonkers-on-Hudson, New York, and Chicago, Illinois
Copyright 1932 by World Book Company. Copyright in Great Britain. *All rights reserved*

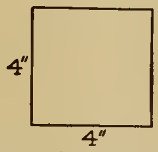
PRINTED IN U.S.A. MAT: ADV. ARITH.: A–16

The graph below shows the number of words spelled by John Marks on each of 10 weekly spelling tests of 25 words.



45. On which two weeks did John spell correctly the same number of words? . . . .

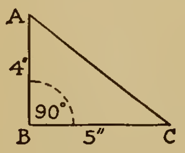
46. The largest gain in one week was —— . . . .



47. The above figure is called a —— . . . . . .

48. Its perimeter is —— . in.

49. Its area is —— . . . . sq. in.



50. The area of the above figure is —— . . . . . . sq. in.

51. Line AC is called the —— . . . .

52. Find the average of 5, 7, 9, 11, 13, 15 . . . .

53. Selling price = \$2,500
Rate of commission = 18%
Commission = —— . . \$

54. Principal = \$800
Time = 1 yr. 3 mo.
Rate = 4½%
Interest = —— . . . \$

55. Marked price = \$425
Discounts = 15% and 20%
Net price = —— . . \$

56. Principal = \$570
Time = 30 da.
Rate = 6%
Amount = —— . . . \$

57. Assessed value = \$12,000
Tax rate = \$2.32 per \$100
Tax = —— . . . . \$

58. $2x - 4 = 12$ . . . . $x =$

59. $8x - 4x - 9x + 7x =$

60. $\frac{2}{3}n + 8 = 10$ . . . . $n =$

STOP!

No. RIGHT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Score	*30*	*31*	*32*	*33*	*34*	*35*	*36*	*37*	*38*	*39*	*40*	*41*	*42*	*43*	*44*	*45*	*46*	*47*	*48*	*49*	*50*	*51*	*52*	*53*	*54*	*55*	*56*	*57*	*58*	*59*	*60*	*61*	*62*	*63*

No. RIGHT	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Score	*64*	*66*	*67*	*68*	*69*	*70*	*71*	*72*	*73*	*74*	*75*	*77*	*79*	*80*	*81*	*82*	*83*	*84*	*85*	*86*	*87*	*89*	*90*	*91*	*92*	*93*

No. attempted. . . . .
No. wrong. . . . .
No. right. . . . .

Score, Test 1 . . . . . .

TEST 2. ARITHMETIC PROBLEMS

Directions. Work each problem and write the answer in the box after the problem. Do your work in the margin at the right of the page.

---

1. My mother bought a gallon can of maple syrup, which she put into pint jars. How many pint jars did she use? 1

2. A bill for pencils for our school store was $4.32. If the pencils were 3¢ each, how many should we have received? 2

3. Apples are selling at 4 for 10¢. How much should I pay for 2 dozen? . . . . ¢ 3

4. Emil's father got 18 baskets of berries. He said he would give a quarter of them to his brother and a quarter to a neighbor and keep the rest. How many baskets was he going to keep? 4

5. Nellie practices her music lessons $\frac{3}{4}$ hour every day. How many hours of practicing does she do in 7 days? . . . . hr. 5

6. Mr. Nelson bought a table for $12.75. He paid $1.50 to have it carted to his shop. He spent $1.69 to repaint it. He sold it for $20.00. How much did he gain on it? $ 6

7. Nan was told to buy 8 pounds of nuts for a party. If they come in 8-ounce boxes, how many boxes should she buy? 7

8. Mother sent Mary to the store for $\frac{1}{2}$ gallon of vinegar. How many quarts did she get? qt. 8

9. John paid 25¢ for his lettuce seed. He sold 78 heads of lettuce for 5¢ a head. How much did he make on his lettuce? . . . . $ 9

10. Mrs. Hall bought a $2\frac{3}{4}$-yard piece of cotton cloth and a $1\frac{1}{2}$-yard piece. How much did she buy all together? . . . . yd. 10

11. Mr. Lane bought a new flagpole for his front yard. It is $28\frac{7}{8}$ feet long. If he puts it $4\frac{1}{2}$ feet into the ground, how many feet of the pole will be above ground? . . . . ft. 11

12. If Bert puts 25¢ in the bank each week, how much money will he save in a year? . . . . . . $ 12

13. After each sale of dress goods, the clerk marked on a little tag the amount of material left. If $2\frac{7}{8}$ yards were sold from a piece containing $10\frac{3}{4}$ yards, what should the clerk write on the tag? . . . . yd. 13

(*Go right on to the next page.*)

14. Bob worked $4\frac{1}{2}$ hours on Monday, $3\frac{3}{4}$ hours on Tuesday, and 4 hours on Thursday. At 40¢ an hour, how much did he earn? . . . . .

$ 14

15. How many pieces, $\frac{7}{8}$ yard in length, could you cut from $3\frac{1}{2}$ yards of linen? . . . .

15

16. What will ice cream for 256 persons cost if you allow 1 quart of ice cream for 8 persons and pay $2.00 a gallon for it? . . . .

$ 16

17. To go to Morristown, which is 30.8 miles from New York City, you pass through South Orange, which is 14.9 miles from New York City. How far is it from South Orange to Morristown? . . . .

mi. 17

18. Nancy had the following marks in her mid-term tests: 92, 68, 84, 74, and 100. What was her average mark? . . . .

18

19. Newton is $5\frac{3}{4}$ miles north of camp, and Andover is $6\frac{1}{2}$ miles north of Newton. How far is it from camp to Andover and back?

mi. 19

20. My father earns $240 a month. We spend $\frac{1}{4}$ of it for rent, $\frac{5}{8}$ of it for other expenses, and save the rest. How much money do we save a month? . . . .

$ 20

21. Max wants to make a yard for his rabbits, which will measure 6 feet 4 inches by 4 feet 8 inches. How much will the wire netting to enclose it cost at 10¢ a foot? . . . .

$ 21

22. Mr. Jones took in $3537 in the 27 business days of July. How much did he average for one day? . . . .

$ 22

23. Our butcher had on his counter a cut of meat that weighed 12 pounds. From this cut, the roast we bought weighed 4 pounds 12 ounces. How much meat was left? . . . .

lb. oz. 23

24. My bedroom is 12 feet by 16 feet. How much will it cost to scrape and varnish the floor at 12¢ a square foot? . . . .

$ 24

25. Stone Bros. have failed in business and state that they can pay only 70 cents on the dollar. They owe Dan's father $10,500. How much should he receive? . . . .

$ 25

26. Lena's sister earns $32 a week. Every Monday she puts $4 in the bank. What per cent of her money does she save? . . . . .

% 26

27. Our ball team played 12 games and won 9. What per cent of their games did they win?

% 27

(Go right on to the next page.)

28. Our kitchen is 15 feet by 12 feet. Linoleum costs $1.75 a square yard. If it costs 10¢ a square yard to lay it, what will it cost to cover our kitchen floor?	$	28
29. My father wishes to lay a cement walk, 18 inches wide, from our kitchen door to the garage, a distance of 28 feet. What will the walk cost at 25¢ a square foot?	$	29
30. Our luncheon napkins are 9 inches on a side. How many can we cut from 1 square yard?		30
31. How many feet of fencing are needed to enclose a lot 30 yd. 1 ft. by 20 yd. 2 ft.? . .	ft.	31
32. To make concrete, cement and sand should be mixed in the ratio of 1 bag of cement to 3 of sand. How much cement must I use if I use 12 bags of sand?		32
33. If I own property assessed at $8500 in a city where the tax rate is $2.54 per $100, how much is my tax?	$	33
34. Mr. Brown is told that, on a $1200 auto, he may have discounts of 10% and 10%, or one discount of 20%. How much would the auto cost him if he took the better offer?	$	34
35. Find the amount of $400 loaned for 1 year, 1 month, 15 days, at 4%.	$	35
36. How many square yards are in the area of a field shaped like a right triangle, having a base of 180 feet and an altitude of 120 feet?	sq. yd.	36
37. How much interest will John's father have to pay on a loan of $760 for 60 days at 6%?	$	37
38. The school paper offers 16$\frac{2}{3}$% commission to pupils who secure advertisements. Sam wants to earn $30 this term. How many dollars' worth of advertising must he get?		38
39. General Motors stock was selling at 47$\frac{1}{8}$. How much would I pay for 25 shares if, besides the cost of the shares, I had to pay 17$\frac{1}{2}$¢ a share brokerage?	$	39
40. Tony pays 50¢ for each 200 pounds of ice. If he sells it at 15¢ for a 25-pound piece, how much does he make on 200 pounds? . .	¢	40

STOP!

No. RIGHT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Score	*35*	*37*	*38*	*40*	*42*	*43*	*44*	*46*	*47*	*49*	*50*	*52*	*54*	*55*	*57*	*59*	*60*	*62*	*64*	*65*	*67*	*68*	*70*	*72*	*73*	*75*	*76*	*78*	*80*	*81*	*83*	*84*	*86*	*88*

No. RIGHT	35	36	37	38	39	40
Score	*89*	*91*	*92*	*94*	*96*	*98*

No. attempted. . . . .
No. wrong. . . . .
No. right. . . . .

Score, Test 2. . . . . .

BOSTON UNIVERSITY
1 1719 02554 6153